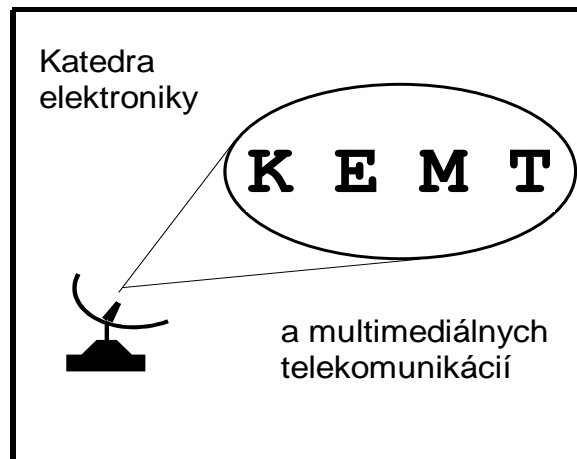

DEPARTMENT OF ELECTRONICS AND MULTIMEDIA TELECOMMUNICATIONS



Annual Report

1999

The Technical University of Košice
Faculty of Electrical Engineering and Informatics

THE TECHNICAL UNIVERSITY OF KOŠICE
Faculty of Electrical Engineering and Informatics
(Slovak Republic)

DEPARTMENT OF ELECTRONICS AND
MULTIMEDIA TELECOMMUNICATIONS

ANNUAL REPORT 1999

Edited by Ľuboš Ovseník

Contents

1. BRIEF OVERVIEW.....	2
2. DEPARTMENT STAFF AND STRUCTURE	3
3. DIVISIONS OF THE DEPARTMENT.....	4
4. COURSES.....	6
Master Degree Course (title Ing.) – Electronics and Telecommunication Engineering	6
Bachelor Degree Courses (title BcC.) – Telecommunications Engineering	6
Ph.D. Degree Courses (title Ph.D.) – Electronics.....	6
Ph.D. Degree Courses (title Ph.D.) – Telecommunications	6
Ph.D. Degree Courses (title Ph.D.) – Measurement Techniques.....	6
5. LIST OF SUBJECTS TAUGHT.....	7
6. RESEARCH AND PROJECTS	8
7. EQUIPMENT	18
8. CO-OPERATION	19
Co-operation in Slovakia	19
International Co-operation.....	19
9. FACULTY ESSAYS	20
10. LIST OF Ph.D. STUDENTS	23
11. MEMBERS.....	24
12. PUBLICATION ACTIVITY OF THE DEPARTMENT	26

1. BRIEF OVERVIEW

The Department of Electronics and Multimedia Communications is responsible for degree course Electronics and Telecommunication Engineering at MSc. level as well as 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, optoelectronics, 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 converters 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 changed 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 changed 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

- ◆ Professors: Anton Čižmár, Dušan Levický, Linus Michaeli, Ján Mihalík, Ján Turán
- ◆ Assoc. Professors: Ľubomír Doboš, Dušan Kocur, Jozef Juhár, Stanislav Marchevský
- ◆ Assistant Professors: Miloš Drutarovský, Pavol Galajda, Ján Gamec, Mária Gamcová, Iveta Gladišová, Zita Klenovičová, Emil Matúš, Ľuboš Ovseník, Ján Šaliga, Jozef Zavacký
- ◆ Support staff: František Botta, Ingrid Hroncová, Pavlina Chocholová, Ľudmila Maceková, Božena Marchevská, Jozef Lenárt, Viera Šumáková
- ◆ Ph.D. students:
Internal form: Stanislav Benčo, Martin Benča, Václav Čarnogurský, Peter Marenčák, Roland Holzer, Robert Hudec, Rastislav Lukáč, Milan Marcinek, Radovan Pundžák, Jaroslav Tlučák, Rudolf Zetík, Csaba Stupák, Marek Čandík, Bohumír Jelinek, Roman Palitefka, Vladislav Sedlák, Martin Dulina
External form: Ľudovít Hintoš, Martin Kapinos, Miroslav Žirko, Alena Galajdová, Ladislav Mihalčík, Pavol Mikulík, Ján Fedor, Gabriel Hanko, Juraj Futó, Mária Gamcová, Ľudmila Maceková, Ľuboš Ovseník

3. DIVISIONS OF THE DEPARTMENT

◆ Laboratory of Multimedia Communications

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

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◆ Laboratory of Digital Signal Processing and Satellite Communications

Head: Assoc. prof. Doc.Ing. Stanislav Marcheuský, CSc.

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Researcher Ing. Ľudmila Maceková

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◆ **Laboratory of Digital Image Processing and Videocommunication**

Head: prof. Prof. Ing. Ján Mihalík, 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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◆ **Laboratory of Electronic Circuits & Measurement**

Head: prof. Prof. Ing. Linus Michaeli, CSc.

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e-mail: Pavol.Galajda@tuke.sk

4. COURSES

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 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 achieve good skills in digital communication and transmission systems, mobile and satellite communications, optoelectronics communication systems and multimedia communication.

Bachelor Degree Courses (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.

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 filtration as well as design of electronic and optoelectronics systems, sensor systems and digital circuits 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

Subjects

Lectures

2nd year of study:

Electronic Devices
Electronic Devices and Systems

Gamec
Galajda

3rd year of study:

Digital Electronics
Acoustics
Digital Communication Systems
Transmission of Information in Electroenergetics
Linear Analog Circuits
Non-Linear Analog Circuits
Signals and Systems
Design of Electronic Equipment
Microwave Technology
Analog Electronic Systems

Levický
Juhár
Levický
Čižmár
Kocur
Michaeli
Zavacký
Doboš
Gamec
Zavacký

4th year of study:

Coding and Modulation
Microprocessors in Electronic Systems
VLSI Processors in Telecommunication
Digital Transmission Systems
Digital Filtering
Electronic Measurement
Analog & Digital Interfaces
Switching Systems
Digital Signal Processing
TV Systems
Optoelectronics
Optoelectronic Communications
Signal Recording
Applied Cryptography

Čižmár
Levický
Drutarovský
Čižmár
Kocur
Šaliga
Michaeli, Šaliga
Marchevský
Mihalík
Marchevský
Turán
Turán
Juhár
Levický

5th year of study:

Multimedia Communications
Radioelectronic Systems
Sensor Systems
Digital Image Communication Systems
Medical Electronics
Photonics
Satellite Communications
Mobile Communications

Levický
Doboš
Michaeli
Mihalík
Michaeli
Turán
Marchevský
Doboš

6. RESEARCH AND PROJECTS

Title of the Project: *Spread-Spectrum Systems and Techniques in Wireless and Wired Communications*

Funding: COST 262

Collaboration with: 18 research and industrial institutions from European countries

Duration: 1999-2002

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

Group members: D. Kocur, M. Drutarovský, P. Galajda, S. Marchevský, S. Benčo,
V. Čarnorgurský

Scientific goals/research targets:

◆ General Goal:

- to increase the knowledge of spread-spectrum techniques and applications for any wireless and wired system and to propose common products and methods for a variety of possible applications

◆ Partial Goals:

- Investigation of any spread-spectrum application, a classification and registration of common features and differences. A tutorial on existing techniques and standards will be given as a result of this activity.
- Spread-Spectrum systems architectures and modulation concepts (direct-sequence spread-spectrum, frequency - hopping, time hopping, hybrid spread-spectrum methods).
- Receiver implementation for spread-spectrum communication systems.
- Equalisation and interference rejection in spread-spectrum communication systems.

Results Achieved:

- ◆ Preparation of a review of basic spread-spectrum systems architectures and modulation concepts is being in progress.

Title of the Project: *Continuous speech recognition over the telephone*

Funding: COST 249

Collaboration with: 23 research institutions, 5 operators, 1 industry institution from
European Countries

Duration: 1994-2000

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

Group members: L. Doboš, J. Juhár, B. Jelínek, M. Marcinek, J. Tlučák

Scientific goals/research targets:

- ◆ System configuration of continuous speech recognizers.
- ◆ Linguistic speech processing.
- ◆ Phonetic decoding.
- ◆ Acoustic signal processing.

Results Achieved:

- ◆ To initiate systematic approach of Slovak language analysis for the purpose of Slovak spoken speech database creation. As the first step to propose Slovak phonetic transcription comparable to existing standards, predominantly to SAMPA transcription.
- ◆ Acoustic modelling of speech based on Hidden Markov Models (HMM), Artificial Neural Networks (ANN) as well as hybrid HMM/ANN approach with primary focusing on continuous spoken Slovak speech recognition over the telephone line.
- ◆ To study robust methods for speech recognition in adverse conditions with concentration on noise robust features extraction techniques, noise immune auditory features and noise-removal pre-processing techniques.

Title of the Project: *Mobile computing for telematic services*

Funding: INCO/COPERNICUS PL 961 114

Collaboration with:

- ◆ LORACOM Institute - University of Nancy, France
- ◆ Department of Telecommunications - University of Mining and Metallurgy Krakow, Poland
- ◆ Department of Communication System - University of Catania, Italy
- ◆ Department Electronics and Multimedia Communication, Technical University of Košice
- ◆ Foundation for Progressing Telecommunications - Krakow, Poland

Duration: 1998-2000

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

Group members: D. Levický, L. Doboš, J. Juhár, R. Palitefka

Scientific goals/research targets:

- ◆ Evaluation of the possibility of data and multimedia services provision in cellular and ATM radio network.
- ◆ Evaluation of the possibility of isochronous and multimedia services provision in cellular and ATM radio network.
- ◆ Study of management and control mechanism, which are targeted to ensure provision of telematic services at highest possible QoS through simulation and analytical modelling.
- ◆ Selection and specification services offered in wireless network.
- ◆ Specification of field trials in term of users services, application and infrastructure.
- ◆ Development of telematic services for health and education.
- ◆ Testing of telematic services in field trials.

Results Achieved:

- ◆ To evaluate the possibility of provision of isochronous and multimedia services in wireless LANs including IEEE 802.11, HIPERLAN.
- ◆ To evaluate the possibility of provision of data and multimedia services in digital cellular radio networks (GSM, DCS, GPRS).
- ◆ To evaluate the possibility of provision of data and multimedia services in wireless ATM networks.

Title of the Project: *Multimedia data processing and transmission in telecommunication networks*

Funding: Institutional grant

Duration: 1997-1999

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

Group members: A. Čižmár, E. Matúš, S. Marchevský, D. Kocur, M. Drutarovský, J. Juhár, L. Doboš, Z. Klenovičová, M. Gamcová, L. Maceková, M. Čandík, I. Hendel, R. Stanko

Scientific goals/research targets:

- ◆ The new methods of image data transmission in broadband telecommunication network.
- ◆ Speech transmission in telecommunication network.
- ◆ Digital filtration of multimedia data.

Results Achieved:

- ◆ Simulation of new method of image sequence coding by using wavelet transform.
- ◆ Implementation of fractal image coding in digital watermarking.
- ◆ Development of speaker-independent recognition system for recognition of Slovak numerals based on acoustic modelling of phonemes with Continuous Density Hidden Markov Models.
- ◆ Comparison of protocols in Broadband Wireless ATM networks for Medium Access Control.
- ◆ Realisation of impulse detector for gray-scale images.
- ◆ Building up a review of basic concepts of time-frequency signal representations.
- ◆ Proposal of a new modification of modified pseudo-Wigner distribution called as dual modified pseudo-Wigner distribution.
- ◆ Order bispectrum property analysis.
- ◆ Proposal of parametric method of order bispectrum estimation.

Title of the Project: *Digital Signal Processing in Multimedia Communications*

Funding: VEGA 1/5241/98

Duration: 1998-2000

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, M. Čandík, I. Hendel, R. Stanko, R. Palitefka, B. Jelínek, Cs. Stupák, R. Lukáč, R. Hudec

Scientific goals/research targets:

- ◆ Design and verification of the new methods for multimedia data coding and transmission in telecommunication network by using ATM.
- ◆ Design and analysis of methods for speech coding and transmission in mobile communications.
- ◆ Design and verification of intelligent method for image filtering by using neural network.

Results Achieved:

- ◆ New modification of fractal image coding algorithm with faster decoding of original image was proposed.

- ◆ Implementation of fractal image coding in colour image coding.
- ◆ Development of method for neural network implementation in speech enhancement.
- ◆ Development of new method for noise reduction in image by using adaptive LMS L-Filters.
- ◆ Realisation of Median and LUM Smoother Filters by Permutation Group.
- ◆ Proposal of time-invariant and adaptive microstatistic filters for complex signal processing.
- ◆ Proposal of the 3-rd order complex adaptive Volterra equaliser with application for a non-linear channel equalisation in 32-QAM based communication system.

Title of the Project: *TEMPUS TELEEDUCA*

Funding: IB – JEP – 13004 - 98

Collaboration with:

- ◆ Slovak Technical University in Bratislava (STU Bratislava) – co-ordinator and contractor
- ◆ Technical University in Košice (TU Košice)
- ◆ University of Transport and Communication in Žilina (UTC Žilina)
- ◆ Universitat Politecnica de Catalunya in Barcelona (UPC Barcelona)
- ◆ Universitat Oberta de Catalunya in Barcelona (UOC Barcelona)
- ◆ Politecnico di Torino
- ◆ Slovak Telecom Bratislava
- ◆ Ministry of Transport, Post and Telecommunications of Slovak Republic
- ◆ Ministry of Interior of Slovak Republic
- ◆ Siemens Nixdorf Information Systems & Siemens Software House Bratislava
- ◆ Siemens Vienna
- ◆ Alcatel SEL A.G. Stuttgart
- ◆ Alcatel SEL TLH Liptovský Hrádok
- ◆ Telenor Slovakia
- ◆ Ericsson Slovakia

Duration: 1999 - 2001

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

Scientific goals/research targets:

- ◆ The built up network of project partners as an Institution for Distance Education and Teleteaching.
- ◆ Development and provide courses for Distance Education and Teleteaching focused on training of civil servants of state administration offices and staff of state institutions.

Results Achieved:

- ◆ Development of the following courses MULTIMEDIA (Technologies, Networks, European Standards, Recommendations and Rules and Process of their Implementation into the Slovak Information Infrastructure).
- ◆ Development of the following courses INFORMATION SYSTEMS (Applications in State Administration).

Title of the Project: *Digital Image Coding with Very Low Bite Rate for Videotelephones and Multimedia Terminals*

Funding: VEGA, 1/4002/97

Duration: 1997 – 1999

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

Group members: J. Zavacký, I. Gladišová, M. Dulina, J. Fedor, R. Labovský, I. Kuba, M. Kapinos, J. Dzivý, Le Hoang Lien Son, P. Dráb

Scientific goals/research targets:

- ◆ New methods and algorithms for digital image coding with very low bit rate.

Results Achieved:

- ◆ Three – layer neural network vector predictor with sigmoid function and their application on prediction of images.
- ◆ Design of a vector predictive image coding system based on neural network architectures, where the vector predictor is implemented by three – layer perception and vector quantizer by Kohonen self – organizing feature maps.
- ◆ An algorithm for design cosine – modulated FIR filter banks satisfying perfect reconstruction property based on two – channel loss less lattice structure.
- ◆ New modifications of pyramidal lattice vector quantifiers, which use optimal lattices D_4 , E_8 and their fast encoding algorithms.
- ◆ A new efficient method for image/video signal resembling based on block by block approach with overlap and compensation of errors.

Title of the Project : *Hardware implementation of unconventional analogue-to-digital interfaces and their error corrections*

Funding: VEGA, 1/3207/96

Duration: 1999 – 2001

Co-ordinator: Prof. Ing Linus Michaeli, CSc.

Group members: V. Pirč, V. Špány, J. Šaliga, P. Galajda, V. Sedlák, P. Mikulík, A. Galajdová, R. Holzer

Research activity of the group is concentrated on:

The effort of the research performed is focused on the following representatives:

- ◆ ADC and DAC as a quantisator of one analogue input parameter.
- ◆ Classificatory of measuring signals carrying more parameters based upon hardware implemented neural networks.
- ◆ Flip-flop switching sensor as the direct converters of physical quantity to digit.
- ◆ Statistic sensors.
- ◆ Application of neural networks in instrumentation.

Scientific goals/research targets:

The common objective is the study of methods how to increase accuracy and reliability AD and DA converting systems. The proposed methods is oriented on the digital signal processes for error correction under different working condition. The single tasks are:

- ◆ The research in the field of neural networks is oriented on its utilisation for signal processing with help of its high grade of parallelism and for multiparametrical quantisation in the measurement applications.
- ◆ The area of the statistical sensor research. is the study of the impact of the measured physical quantity on the equivalent voltage. The importance is given on the statistical sensor with feedback where the sensor's behaviours are studied by the developed algorithm and the waving separatrix.
- ◆ The common error criteria and the mathematical description are established in order to settle a converter error model giving possibility to utilise results from the testing in the reduced number of significant points. The error values from mentioned points together with known model allow approximating the error function over the whole working range.

- ◆ Another task is the research of different testing methods, preferably those, which reduce the performing time. The outcome of this stage is preparation of new standards for assessment of all kinds of neural and classical converters.

Results Achieved:

- ◆ Enhancement of dynamic range by oversampling and successive low pass filtering causes arising of the parasitic effects generated by systematic errors of the range below few LSB of integral nonlinearity INL(k). The outcomes of the research allow achieving systematic error reduction by changes in the oversampling flux according to known probabilistic model of the corrected SAR ADC.
- ◆ Study of histograms testing method using small amplitude sine or triangular waves superimposed with variable DC level.
- ◆ Neural networks allow distinguish patterns represented by combination of two frequencies according to CCITT recommendation. Neural networks were software simulated and later implemented on customized both analogy and digital neural chip (ETANN 80170NX by Intel and DSP TMS 320C30 by Texas Instruments).
- ◆ Another research outcome related to neural network is new programming method of deterministic mathematical operation. This application was aimed on reduction of parasitic quantity impact on the sensor system using redundant output information. This application was tested by customer designed analogue neural structure.
- ◆ The stochastically sensors are based on the probability evaluation of chosen stable state for flip-flop circuit occurrence under repetitive connection to the supply source. The improvement of this idea by autocompensative system allows to linearise the transfer characteristic with better resistance against parasitic electromagnetic interference.

Title of the Project: *Fibre Optic Communication and Sensory Systems*

Funding: Institutional grant, G - 42144

Duration: 1997 – 1999

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

Group members: Ľ. Ovseník, P. Marenčák, M. Benča, P. Farkaš

Collaboration with: Prof. E.F. Carome, John Carrol University, Cleveland, USA

Scientific goals/research targets:

- ◆ Modelling digital optical fibre communication systems.
- ◆ Modelling optical fibre sensor systems.

Results Achieved:

- ◆ Potential fiber optic networks architectures are analysed and modelled with the applications in multimedia communications, electrical power industry and digital image transmission in private networks.
- ◆ A software package for fiber optics communication networks design.
- ◆ Multimedia courseware: Optical Communications.
- ◆ Designed and extensively tested an innovative fiber optic index of refraction sensory system that has unique properties. Two variants: portable device and laboratory PC controlled and were developed.
- ◆ Optically powered fiber optic sensory system with weary low power consumption was developed.

Title of the Project: *Visual Signal Processing in Intelligent Communications Terminals***Funding:** VEGA 1/4017/97**Duration:** 1997 – 1999**Co-ordinator:** Prof, RNDr. Ing Ján Turán, DrSc.**Group members:** Ľ. Ovseník, J. Futó, P. Marenčák, M. Benča, P. Farkaš**Collaboration with:**

- ◆ Prof. K. Fazekas, TUB, Budapest, Hungary
- ◆ Prof. A. C. Davies, King's College, London, United Kingdom
- ◆ Prof. A. Figueras, University Carlos III, Madrid, Spain
- ◆ Prof. J. Tasic, TU Ljubljana, Slovenia
- ◆ Prof. P. P. L. Regtien, University of Twente, Niderland

Scientific goals/research targets:

- ◆ Design new invariant image classification systems based on non-linear fast translation invariant transforms (RT), Radon transform and Mellin Transform.
- ◆ Design new invariant associative memory.
- ◆ New methods for visual signal processing in intelligent GUI's in multimedia systems for teleeducation and teleworking.

Results Achieved:

- ◆ Software tested for CAE and CAD of invariant image processing systems based on transforms from the class CT.

- ◆ Invariant image associative memory massed on STIR transform.
- ◆ New 3D – object recognition system based on the use of rapid transform (RT).
- ◆ Multimedia courseware: Rapid transform and its applications.
- ◆ New methods for invariant image classifications based on the GMDH and CT.

Title of the Project: *Facilities for Communication Terminals*

Funding: COST 254

Collaboration with: France, Italy, Norway, Hungary, Spain (Project coordinator: Prof. A.R.Figueiras-Vidal, EPS - Universidad Carlos III, Madrid), Slovenia, Poland, Portugal, Ireland, Greece, Belgium, Switzerland.

Duration: 1996 – 2001

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

Group members: J. Gamec, L. Ovseník, P. Marenčák, M. Benča

Scientific goals/research targets:

- ◆ The project represents a theoretical base for the emergent new telecommunication terminals.

Results Achieved:

- ◆ The project represents a theoretical base for the emergent new telecommunication terminals. The work is done in Working Groups:
 - *WG.1G:* Emerging Techniques for Terminal Hardware and Software.
 - *WG.2G:* Distributing Intelligence (Terminal to Terminal, Terminal versus Network).
 - *WG.3A:* Integrating Transmission, Computing, Processing, and User Needs at Terminals for Specific Applications.
- ◆ Our research group will focus on special applications, such as teleworking and teleeducation terminals.

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 digital signal processors Motorola DSP56XXX, Analog Devices ADSP218X. Altera Corporation University Program - Design Laboratory Package
Laboratory of Measurement	Special measurement system
Laboratory of Microcontrollers 8051, and VLSI Processors	Development tools for single chip microcomputers PIC
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

8. CO-OPERATION

Co-operation in Slovakia

<i>Institution</i>	<i>Type of activity</i>
Slovak Telecom Bratislava	Rsearch, TEMPUS
Alcatel SEL Liptovský Hrádok	TEMPUS
Siemens Software House Bratislava	TEMPUS
Ericsson Slovakia	TEMPUS
Telenor Slovakia	TEMPUS
Acatel Bussiness System Bratislava	TEMPUS

International Co-operation

<i>Institution</i>	<i>Type of activity</i>
Alcatel SEL Stuttgart	TEMPUS
Siemens Viena	TEMPUS
UPC Barcelona	TEMPUS
Politecnico di Torino	TEMPUS
Loracom France Nancy	INCO/COPERNICUS
University of Catania Italy	INCO/COPERNICUS
University of Mining and Metallurgy Krakow	INCO/COPERNICUS
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 Firenze Italy	COST
University of Gent	COST
University of Salerno Italy	TEMPUS / SOCRATES
University of Calabria Italy	TEMPUS / SOCRATES

9. FACULTY ESSAYS

Čižmár Anton

Full professor

His research interests include speech processing, neural networks, data compression and digital communications.

Doboš Ľubomír

Associated professor

His research interest include digital processing of speech, namely adaptive noise cancellation, and digital communication systems with force to mobile communication systems as are GSM, GPRS, VMTS, wireless ATM and implementation of mobile telematic services.

Drutarovský Miloš

Assistant professor

His research interests include digital communications, cryptography and digital signal processors.

Galajda Pavol

Assistant professor

His present fields of interest are multiple - valued logic systems and its application, dynamic properties of a multiple-valued sequential circuit and programmable logic devices (PhDs).

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, and an algorithm for lattice and pyramid quantizers and codes.

Hroncová Ingrid

Research assistant

Her professional area of interests is a digital signal processing, digital speech processing, transform coding and metropolitan area network.

Juhár Jozef

Associated professor

His research interests include digital signal processing of speech and audio and topics related to automatic speech recognition in adverse environment.

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, especially in linear and non-linear time-invariant and adaptive digital filters, higher-order spectra and spread spectrum communication systems.

Levický Dušan*Full professor*

His main interests and activities are in the digital signal processing, picture processing and transmission, cryptography.

Maceková Ľudmila*Research assistant*

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

Marchevský Stanislav*Associated professor*

His main research interests are multidimensional digital filters, linear and non-linear digital filters for image processing.

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 hardware implementation of the neural networks for measuring systems.

Mihalík Ján*Full professor*

His current research interest includes signal and information theory, digital image processing (including effective coding, restoration, enhancement and statistical filtering), digital image communication.

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*Assistant professor*

His general research interests include neural networks in charge of an amplitude shape pulse detector, 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. LIST OF Ph.D. STUDENTS

Name	Supervisor	Degree Course
First year of study		
Stanislav Benčo	Marchevský	Telecommunications
Václav Čarnogurský	Kocur	Electronics
Pavel Farkaš	Turán	Electronics
Roland Holcer	Michaeli	Measurement technique
Peter Radoczi	Levický	Telecommunications
Jalal Mahmood Abdulghafoor (df.)	Levický	Telecommunications
Pavol Drab (df.)	Mihalík	Telecommunications
Ľubomír Horniak (df.)	Michaeli	Measurement technique
Second year of study		
Martin Benča	Turán	Electronics
Peter Marenčák	Turán	Electronics
Robert Hudec	Kocur	Telecommunications
Rastislav Lukáč	Marchevský	Telecommunications
Milan Marcinek	Čižmár	Telecommunications
Radovan Pundžák	Levický	Telecommunications
Jaroslav Tlučák	Levický	Telecommunications
Mária Gamcová (df.)	Marchevský	Telecommunications
Ľudovít Hintoš (df.)	Čižmár	Telecommunications
Martin Kapinos (df.)	Mihalík	Telecommunications
Third year of study		
Rudolf Zetík	Kocur	Electronics
Csaba Stupák	Marchevský	Electronics
Bohumír Jelinek	Čižmár	Telecommunications
Roman Palitefka	Čižmár	Telecommunications
Vladislav Sedlák	Michaeli	Measurement technique
Alena Galajdová (df.)	Michaeli	Measurement technique
Marek Čandík (df)	Levický	Telecommunications
Miroslav Žirko (df)	Čižmár	Telecommunications
Fourth year of study		
Ladislav Mihalčík (df.)	Marchevský	Electronics
Pavol Mikulík (df.)	Michaeli	Measurement technique
Ján Fedor (df.)	Mihalík	Telecommunications
Fifth year of study		
Ľuboš Ovseník (df.)	Turán	Electronics
Juraj Futó (df.)	Turán	Electronics

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.

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.

Juhár Jozef, Member of the Slovak Acoustic Society.

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, Member of Scientific Board of Military Academy Liptovský Mikuláš.

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.

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 7 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, Coordinator of IMEKO Working Group "AD and DA metrology".

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, Member of New York Academy of Sciences.

Turán Ján, Member of Slovak Optical Committee of the Slovak Academy of Science.

Turán Ján, Senior Member of the IEEE.

Turán Ján, Member of Czech and Slovak Radioelectronics Society.

Turán Ján, Member of Editorial Board of the journal Radioengineering.

12. PUBLICATION ACTIVITY OF THE DEPARTMENT

Books:

- [1] Čižmár,A.-Doboš,L.-Palitefka,R.: Mobilné ATM siete (Mobile ATM Networks). Elfa press, Košice, 1999, ISBN 80-88964-08-3, (in Slovak).
- [2] Turán.J.: Fast Translation Invariant Transforms and Their Applications. Elfa press, Košice, 1999, ISBN 80-88964-19-9, 158 pp.
- [3] Turán.J.: Optické komunikačné systémy (Optical Communications Systems). Elfa press, Košice, 1999, ISBN 80-88964-20-2, 239 pp., (in Slovak).

Journal Papers:

- [1] Arpaia P.-Daponte,P.-Michaeli,L.: The Influence of the Architecture on ADC Modeling. IEEE Transactions on Instrumentation and Measurement, Vol. 48, No. 5, October 1999, 1283-1287.
- [2] Arpaia.P.-Daponte,P.-Grimaldi,D.-Michaeli,L.: Systematic Error Correction for Experimentally Modeled Sensors by Using ANNs. IMTC/99 Proceedings of the 16th IEEE Instrumentation and Measurement Technology Conference, Venice, Italy, Vol. 3, May 24-26, 1999, 1635-1640.
- [3] Arpaia P.-Daponte,P.-Michaeli,L.: A Dynamic Error Model for Integrating Analog-to-Digital Converters. Measurement, Vol. 25, 1999, 255-264.
- [4] Čižmár,A.: 30th Anniversary of the Faculty of Electrical Engineering and Informatics the Technical University of Košice. Journal of Electrical Engineering, Vol. 50, No. 7-8, 1999, 170-172.
- [5] Čižmár,A.: Základné otázky bezdrôtových a mobilných ATM sietí. Telekomunikace, No. 7-8, 1999, 18-21, (in Slovak).
- [6] Doboš,L.-Juhár,J.-Čižmár,A.: Medium Acces Control Protocols for Wireless ATM. Radioengineering, Vol. 8, No. 2, June 1999, 31-36.
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- [8] Drutarovský,M.: GSM Channel Equalization Algorithm – Modern DSP Coprocessor Approach. Radioengineering, Vol. 8, No. 4, December 1999, 26-31.
- [9] Galajda,P.-Guzan,M.-Špány,V.: The State Space Mystery with Negative Load in Multiple-Valued Logic. Radioengineering, Vol. 8, No. 2, June 1999, 2-7.
- [10] Gamec,J.-Turán,J.: Motion Analysis Based on Invertible Rapid Transform. Radioengineering, Vol. 8, No.2 , June 1999, 12-19.

- [11] Grimaldi,D.-Michaeli,L.-Palumbo,A.: Automatic and Accurate Evaluation of the Parameters of the Magnetic Hysteresis Model. IEEE Trans. on Instrumentation and Measurement. Vol. 48, 1999.
- [12] Lukáč,R.: Impulse Detection By Entropy Detector (H – Detector). Journal of Electrical Engineering, Vol. 50, No. 9-10, 1999, 310-312.
- [13] Matúš,E,-Levický,D.: Interactive Progressive Image Transmission. Radioengineering, Vol. 8, No. 2, June 1999, 8-11.
- [14] Marchevský,S.-Stupák,Cs.: Fuzzy Stack Filters for Image Processing. Radioengineering, Vol.8, No. 2, June 1999, 25-30.
- [15] Marchevský,S.-Kocur,D.-Mihalčík,L.-Galajda,P.-Drutarovský,M.: Computation Based on a Bank of Digital FIR Filters. Journal of Electrical Engineering, Vol. 50, No. 7-8, 1999, 211-216.
- [16] Michaeli,L.-Šaliga,J.: An Educational Application of Distributed Measurement Systems. Radioengineering, Vol. 4, No. 5, April 1999, 20-24.
- [17] Kocur,D.-Zetík,R.: Time-Frequency Analysis of Signals Generated by Rotating Machines. Radioengineering, Vol. 8, No. 2, June 1999, 37-42.
- [18] Levický,D.-Čandík,M.-Pundžák,R.: Some Modifications of Fractal Image Coding. Radioengineering, Vol. 8, No. 3, September 1999, 12-16.
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- [21] Tlučák,J.-Juhár,J.-Doboš,L.-Čižmár,A.: Neural Network Based Speech Enhancement. Radioengineering, Vol. 8, No. 4, December 1999, 22-25.
- [22] Zavacký,J.-Mihalík,J.: An Algorithm for Design of Cosine Modulated Filter Banks with Perfect Reconstruction. Journal of Electrical Engineering, Vol. 50, No 5-6, 1999, 122-126.

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- [1] Arpaia.P.-Daponte,P.-Michaeli,L.: The Influence of the Architecture on ADC Error Modeling. 4th Workshop on ADC Modelling and Testing, Bordeaux, France, September 9-10, 1999, 132-141.
- [2] Arpaia.P.-Daponte,P.-Iannelli,L.-Michaeli,L.: A method for the Optimal Compensation of Dynamic Nonlinearity in SAR ADCs. Proceedings of 4th Workshop on ADC Modelling and Testing, Bordeaux, France, September 9-10, 1999, 159-165.

- [3] Čižmár,A.-Doboš,L.-Palitefka,R.: Comparison of Medium Access Control Protocols for Wireless ATM. DSP'99, The 4th International Conference on Digital Signal Processing, Herľany, Slovakia, September 29-30, 1999, 4-7.
- [4] Čižmár,A.-Doboš,L.: Stratégia možnosti rozvoja a prevádzky širokopásmových prístupových sietí. Rádiové prístupové siete, Banská Bystrica, Slovakia, September 28-29, 1999, 4-8, (in Slovak).
- [5] Čižmár,A.-Doboš,L.-Palitefka,R.:Bezdrôtové a mobilné ATM siete. Súčasnosť a perspektívy. 5. Medznárodné sympóziu o ATM – Kam kráčaš ATM, Bratislava, Slovakia, April 14-15, 1999, 14-17.
- [6] Čižmár,A.-Doboš,L.-Juhár,J.: Využitie neurónových sietí v telekomunikačnom marketingu. TELEKOMUNIKACIE 99, Bratislava, Slovakia, April 27-28, 1999, (in Slovak).
- [7] Čižmár,A.-Doboš,L.-Palitefka,R.: Selected Media Access Control Protocols for WATM. Conference BAC 99, Cracow, Poland, October 11-13, 1999, 69-74.
- [8] Čižmár,A.-Jakab,F.-Samuelis,L.-Zirko,M.: Continuing Professional Development Based on Network Videoconferencing Sites. Int. Symposium: Advances in Multimedia and Distance Education, Baden-Baden, Germany, August 2-7, 1999, 7-10.
- [9] Čižmár,A.: Aktuálny stav a očakávaný rozvoj. Elektrotechnika a informatika na prahu 3.tisícročia“, Košice, Slovakia, September 22, 1999, 11-19, (in Slovak).
- [10] Čižmár,A.-Hintos,L.: Nové telekomunikačné technológie a služby. Elektrotechnika a informatika na prahu 3.tisícročia, Košice, Slovakia, September 22,1999, 39-48, (in Slovak).
- [11] Drutarovský,M.: Demodulator of Analog FM and AM Signals-CORDIC DSP Implementation. DSP'99 The 4th International Conference on Digital Signal Processing, September 29-30, 1999, Herľany, Slovakia, 166-169.
- [12] Drutarovský,M.-Galajda,P.: Implementation of DSP Functions in ALTERA Field Programmable Logic Devices. DSP'99 4th , The International Conference on Digital Signal Processing, September 29-30, 1999, Herľany, Slovakia, 170-173.
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- [14] Gladišová,I.-Mihalík,J.: Combination of Pyramid and Lattice Vector Quantization. DSP'99 The 4th International Conference on Digital Signal Processing. Herľany, Slovakia, September 29-30, 1999, 26-29.
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- [16] Guzan,M.-Špány,V.-Galajda,P.: The State Space Mystery in Multivalued Logic Circuits. DSP'99 The 4th International Conference on Digital Signal Processing, September 29-30, 1999, Herľany, Slovakia, 151-154.
- [17] Hudec,R.-Marchevský,S.: Image Filtering by Two-Dimensional Wiener Filter. 3rd International Scientific Conference „ELEKTRO'99“, Žilina, Slovakia, May 25-26, 1999, 79-83.
- [18] Hudec,R.-Marchevský,S.: Reduction Mixed Noise by Using Adaptive LMS L-Filters. DSP'99, The 4th International Conference on Digital Signal Processing, Herľany, Slovakia, September 29-30, 1999, 29-30, 88-92.
- [19] Jelínek,B.: Numerical Calculations of Planar Symetric Arrays of Cylindrical Dipoles. „RADIOELEKTRONIKA 99“, 9th International Czech-Slovak Scientific Conference, 27-28 April, 1999, Brno, 313-316.
- [20] Kocur,D-Zetík,R.: Wigner Distribution, Spektrogram AND L-Wigner Distribution. „RADIOELEKTRONIKA 99“, 9th International Czech – Slovak Scientific Conference, 27-28 April, 1999, Brno, 110-113.
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- [22] Kocur,D.-Hendel,I.: Microstatistic Filter Design Based on Genetic Algorithm Application. „RADIOELEKTRONIKA 99“, 9th International Czech –Slovak Scientific Conference, 27-28 April, 1999, Brno, 126-129.
- [23] Kocur,D.-Kacvinský,J.: Order Approach to Signal Processing of Signals Generated by Reciprocated Machines. DSP'99 The 4th International Conference on Digital Signal Processing. September, 29-30, 1999, Herľany, Slovakia, 70-73
- [24] Kocur,D.- Hirková,M.: Parametric Method of Order Bispectrum Estimation. DSP'99 The 4th International Conference on Digital Signal Processing, September, 1999, 29-30, Herľany, Slovakia, 74-78
- [25] Kuba,M.-Jarina,R.: Real-Time Implementation of Speech Coder for PC. 3rd International Scientific Conference „ELEKTRO'99“, University of Žilina, May 25-26, 1999, 112-114.
- [26] Labovský,R.-Mihalík,J.: Vector Prediction of an Image by Using Neural Network. „RADIOELEKTRONIKA 99“, 9th International Czech-Slovak Scientific Conference, 27-28 April, 1999, Brno, 419-422.
- [27] Labovský,R.-Mihalík,J.: Neural Network Architectures for Vector Predictive Image Coding. DSP'99 The 4th International Conference on Digital Signal Processing. September ,29-30, 1999, Herľany,Slovakia, 30-33.
- [28] Levický,D.-Petruľák,P.-Radoczi,P.-Šurin,M.: Hybrid Coding of Image Sequences by using wavelets Transform. „RADIOELEKTRONIKA 99“, 9th International Czech – Slovak Scientific Conference, Brno, Czech republic, April 27-28, 1999, 201-204.

- [29] Levický,D.-Čandík,M.-Klenovičová,Z.: Digital Watermarking by using Fractal Image Coding. DSP'99 The 4th International Conference on Digital Signal Processing. Herľany, Slovakia, September , 29-30, 1999, 19-21.
- [30] Lukáč,R.-Marchevský,S.: Digital Image Processing Based on LUM Filters. 3rd International Scientific Conference „ELEKTRO'99“, University of Žilina, May 25-26, 1999, 84-89.
- [31] Lukáč,R.-Maceková,L.-Marchevský,S.: Order Statistic Filters in Dynamic Image Sequences Corrupted by Impulsive Noise. DSP'99, The 4th International Conference on Digital Signal Processing. Herľany, Slovakia, September, 29-30, 1999, 50-53.
- [32] Lukáč,R.-Marchevský,S.: Realization of Median and LUM Smoother Filters by Permutation Group. DSP'99, The 4th International Conference on Digital Signal Processing. Herľany, Slovakia, September 29-30, 1999, 92-95.
- [33] Lukáč,R.-Stupák,Cs.: A Class of Impulse Detectors Controlled By a Threshold. 3rd International Scientific Conference INFORMATION AND ALGORITHMS 99, Prešov, Slovakia, September 9-10, 1999,
- [34] Marcinek,M.-Juhár,J.-Čižmár,A.: Speaker-Dependent Connected Word Recognition by Hidden Markov Modelling. „RADIOELEKTRONIKA 99“, 9th International Czech-Slovak Scientific Conference, Brno, Czech republic, April 27-28, 1999, 405-408.
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- [36] Michaeli,L.-Šaliga,J.-Sedlák,V.: An Approach Diagnostic of the AD Converter Embedded on ATMEL Microcontrollers. Proceedings of 4th Workshop on ADC Modelling and Testing, Bordeaux, France, September 9-10, 1999, 247-252.
- [37] Stupák,Cs.: Digital Image Filtration Based on Local Statistics. 3rd International Scientific Conference „ELEKTRO'99“, Žilina, Slovakia, May 25-26, 106-111.
- [38] Stupák,Cs.-Lukáč,R.: Impulse Detection in Grayscale Images. DSP'99, The 4th International Conference on Digital Signal Processing, Herľany, Slovakia, September 29-30, 1999, 96-99.
- [39] Stupák,Cs.:Digital Image Filtering by Help of Clasifficators. 24th Students Scientific Conference Joined Competition, Budapest, Hungary, April 7-9, 1999, 82.
- [40] Stupák,Cs.:Searching the Optimal Training Set for Neural Stack Filters. 5th International Scientific Conference of the Fund of Jozef Murgaš for Telecommunication Joined with Competition, Bratislava, Slovakia, June 2-3, 1999, 35-38.
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- [43] Turán,J.-Ovseník,L.: Optical Communication: Graphical User Interface for Multimedia Teleeducation Courseware. 5. International Conference TELECOMMUNICATIONS '99 in fair COFAX '99 (Multimedia telecommunications on the way to 3rd Millenium), Bratislava, Slovak Republic, April 27-28, 1999, 116-119.
- [44] Turán,J.-Ovseník,L.: GUI for Multimedia Courseware: OPTICAL COMMUNICATIONS. ELMAR International Workshop on Video Processing and Multimedia Communications, VIPromCom'99, Zadar, Croatia, June 23-25, 1999, 153-157.
- [45] Turán,J.-Ovseník,L.: Optical Communication: Design GUI for Multimedia Teleeducation Courseware. 22. International Convention MIPRO '99, Opatija, Croatia, May 1999, 183-185.
- [46] Turán,J.-Ovseník,L.: Optický vláknový refraktometer (Optical Fiber Refractometer). Optické komunikace '99, Praha, Czech Republic, Nov. 23-24, 1999, (6pp.), (in Slovak).
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- [50] Zavacký,J.-Mihalík,J.-Kapinos,M.: Resampling of an Image by Block-Based Interpolation or Decimation. IWSSIP '99 , 6th International Workshop on Systems, Signals and Image Processing. Bratislava, Slovakia, June 2-4, 1999, 69-72.
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Thesis

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- [2] Lukáč.R.: Viacrozmerná číslicová filtrácia obrazov pomocou permutačnej teórie, LUM filtrov a detektorov impulzov (Multidimensional Digital Image Filtering By Permutation Theory, LUM Filters and Impulse Detectors). Rigorous work, Košice 1999.

- [3] Marenčák,P.: Nelineárne transformácie pre výber invariantných príznačkov. Rigorous work, Košice 1999.
- [4] Ovseník,L.: Modelovanie optických vlákňových komunikačných a senzorových systémov (Modelling Fiber Optic Communications and Sensors Systems). Rigorous work, Košice 1999.

For further information :

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