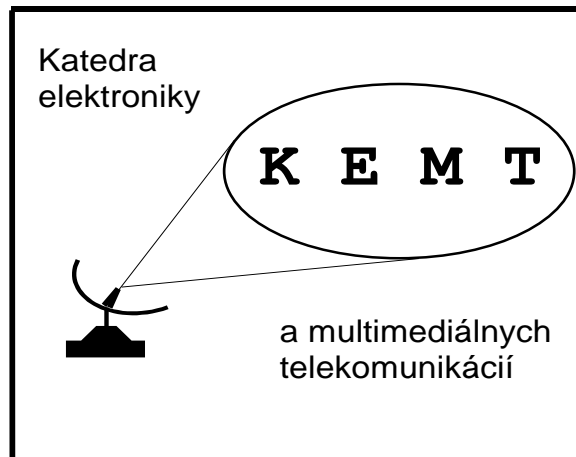

DEPARTMENT OF ELECTRONICS AND MULTIMEDIA TELECOMMUNICATIONS



Annual Report 1998

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 1998

Edited by Ľuboš Ovseník

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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 modeling.

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

Total number of staff members is 26.

- ◆ Professors: Dušan Levický, Linus Michaeli, Ján Mihalčík, Ján Turán
- ◆ Assoc. Professors: Anton Čižmár, Dušan Kocur, Stanislav Marchevský
- ◆ Assistant Professors: Ľubomír Doboš, Miloš Drutarovský, Pavol Galajda, Ján Gamec, Mária Gamcová, Iveta Gladišová, Jozef Juhár, 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: Martin Benča, Peter Marenčák, Robert Hudec, Rastislav Lukáč, Milan Marcinek, Radovan Pundžák, Jaroslav Tlučák, Rudolf Zetík, Csaba Stupák, Marek Čandík, Bohumír Jelinek, Roman Palitefka, Vladislav Sedlák, Imrich Hendel, Radoslav Stanko, 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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Researcher Ing. Ľudmila Maceková

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e-mail: Macekova@hron.ef.tuke.sk

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

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◆ **Laboratory of Optoelectronic Communications**

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◆ **Laboratory of Electronic Circuits & Measurement**

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Assist. prof. Ing. Pavol Galajda, CSc.

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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 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.

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 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

Subjects

Lectures

2nd year of study:

Electronic Devices

Marchevský

3rd year of study:

Digital Electronics

Levický

Acoustics

Juhár

Digital Communication Systems

Levický

Transmission of Information in Electroenergetics

Čižmár

Linear Analog Circuits

Kocur

Non-Linear Analog Circuits

Michaeli

Signals and Systems

Zavacký

Design of Electronic Equipment

Doboš

Microwave Technology

Gamec

Analog Electronic Systems

Zavacký

4th year of study:

Coding and Modulation

Čižmár

Microprocessors in Electronic Systems

Levický

VLSI Processors in Telecommunication

Drutarovský

Digital Transmission Systems

Čižmár

Digital Filtering

Kocur

Electronic Measurement

Šaliga

Analog & Digital Interfaces

Michaeli, Šaliga

Switching Systems

Marchevský

Digital Signal Processing

Mihalík

TV Systems

Marchevský

Optoelectronics

Turán

Optoelectronic Communications

Turán

Signal Recording

Juhár

Applied Cryptography

Levický

5th year of study:

Multimedia Communications

Levický

Radioelectronic Systems

Doboš

Sensor Systems

Michaeli

Digital Image Communication Systems

Mihalík

Medical Electronics

Michaeli

Photonics

Turán

Satellite Communications

Marchevský

Mobile Communications

Doboš

6. RESEARCH AND PROJECTS

Title of the Project: *Innovative Methods of Noise and Vibration Analysis on Reciprocating Machinery for the Purpose of Quality Control and Diagnostics*

Funding: COPERNICUS, project: CIPA-CT94-0220

Collaboration with:

- ◆ Technical University of Ilmenau (Germany)
- ◆ Technical University of Liberec (Czech Republic)
- ◆ Liaz a.s. Jablonec n. Nisou (Czech Republic)
- ◆ Škoda a.s. (Czech Republic)
- ◆ Technical University of Budapest (Hungary)
- ◆ Technical Testing Institute Piešťany (Slovak Republik).

Duration: 1995-1998

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

Group members: D. Kocur, M. Drutarovský, P. Galajda, S. Marchevský, E. Matúš, R. Stanko

Scientific goals/research targets:

- ◆ The project CIPA-CT94-0220 represents an applied research in the field of noise and vibration analysis on reciprocating machinery. It is expected that methods of signal processing, analysis and classification proposed and developed within the project should improve the conditions for development of new low noise and vibration products in the area of machine tools, machinery and automobile industry.
- ◆ The methods and know-how developed within the project should also contribute to the improvement of safety, reliability, and maintainability of the new products.
- ◆ Possible applications range from the quality assurance during the product development stage to quality control during the production stage.

Results Achieved:

- ◆ Based on the intentions declared in the project proposal as well as based on the discussions during regular project workshops the following aims and tasks were set for the DEMC research and development group (R&D): DSP operating system development for miniSYS (miniSYS is a system for real-time digital signal processing based on signal processor DSP 5600X), standard DSP algorithm implementation on

miniSYS, non-conventional methods of signal analysis and development of Toolbox Psychoacoustics.

- ◆ The miniSYS DSP operating system developed at DEMC provides really power support for the digital signal processing algorithm implementation and performance of the miniSYS. At the present time, it is applied with success e.g. at Ford (Spain), ZF and BMW (Germany).
- ◆ In the field of the task „Standard DSP algorithm implementation on miniSYS“ the main stress was put on the implementation of the selected methods of spectrum analysis and order analysis as well as on the implementation of conventional linear time invariant-digital filters. The results of the effort devoted to this tasks solution are incorporated into DSP miniSYS library. In this library, routines for signal windowing (necessary step before spectrum estimation), optimized FFT computation (FFT routines for different sizes with different accuracy and computational complexity), order spectrum estimation based on polyphase windowing method are available.
- ◆ Within the solution of the task „Non-conventional methods of signal analysis“, the DEMC R&D group has been focused on the applications of higher order spectra (HOS) and psychoacoustics. In the field of the HOS a new modification of the bispectrum called order bispectrum was originally developed by DEMC R&D group in co-operation with colleagues from Technical university of Ilmenau. The advantage of the order bispectrum in comparison with that of conventional bispectrum is that the order bispectrum can detect special effects non-detectable by using conventional DFT, order or bispectrum analysis.
- ◆ In the area of the psychoacoustic, DEMC R&D group in co-operation with the Technical Testing Institute Piešťany has developed MATLAB TOOLBOX called Toolbox Psychoacoustics. Toolbox contains all of m-files necessary for evaluation of the basic psychoacoustic parameters from time waveform of the sound pressure. It could be applied with advantage also for printed documentation building on sound signals to be analysed.

Title of the Project: *Continuos 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: Doc. Ing. Anton Čižmár, CSc.

Group members: Jozef Juhár, Bohuš Jelínek, Marcinek, 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 modeling 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 preprocessing 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 - Kralow, Poland

Duration: 1998-2000

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

Group members: Dušan Levický, Lubomír Doboš, Roman 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).
- ◆ 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: Čížmár Anton, Matúš Emil, Marcheuský Stanislav, Kocur Dušan, Drutarovský Miloš, Juhár Jozef, Doboš Ľuboš, Klenovičová Zita, Gamcová Mária, Maceková Ľudmila, Čandík Marek, Hendel Imrich, Stanko Radoslav

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:

- ◆ The new method of digital image sequences by using motion compensation was proposed. The method is a hybrid DPCM-Wavelets coding and DCT transform is replaced by wavelets transform.
- ◆ The new method of pitch detection in speech processing was proposed and tested. The method is based on time frequency analysis and implementation of neural network.
- ◆ The new method of polyspectral signal analysis was proposed mainly the method of bispectrum estimation.
- ◆ Analysis of applications of adaptive non-linear filters in digital transmissions systems.

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: Čižmár Anton, Matúš Emil, Marchevský Stanislav, Kocur Dušan, Drutarovský Miloš, Juhár Jozef, Doboš Ľuboš, Klenovičová Zita, Gamcová Mária, Maceková Ľudmila, Čandík Marek, Hendel Imrich, Stanko Radoslav, Palitefka Roman, Jelínek Bohumír, Stupák Csaba

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:

- ◆ Study and analysis of method for image coding by using waved transform and fractal coding from point of view packet transmission. The new fast method in fractal image decoding by using correlation's was proposed.
- ◆ Study and analysis of wireless system and technology from point of view wireless voice and wireless data transmission based on wireless ATM architecture.

- ◆ The new methods using of Bayesian learning in feedforward neural network was proposed and fuzzy stack filters for image filtering was tested.
- ◆ The method of time invariant conventional and Volterra microstatistic filter design based on genetic algorithm was proposed.
- ◆ A new algorithm of adaptation of adaptive microstatistics filters based on conjugate gradient method was proposed.

Title of the Project: *TEMPUS TELECOMNET*

Funding: No. SJEP O9326-95

Collaboration with:

- ◆ Slovak Technical University in Bratislava (STU Bratislava) - coordinator
- ◆ Technical University in Košice (TU Košice)
- ◆ University of Transport and Communication in Žilina (UTC Žilina)
- ◆ UPC Barcelona
- ◆ Politecnico di Torino
- ◆ Slovak Telecom Bratislava
- ◆ Alcatel Business Systems Bratislava
- ◆ Siemens Vienna
- ◆ Siemens Software House Bratislava
- ◆ Alcatel SEL Stuttgart
- ◆ Alcatel SEL TLH Liptovský Hrádok

Duration: 1.9.1995 - 31.8.1998

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

Scientific goals/research targets:

- ◆ The development of new and restructuring of existing degree courses in telecommunication technologies at MSc a PhD level as well as at level of continuing education at STU Bratislava, TU Košice, UTC Žilina.
- ◆ Building up the training centres at three Slovak partner universities.
- ◆ Students exchange.

Results Achieved:

- ◆ Transformation of degree course Radioelectronics to the new degree course Electronics and Telecommunication engineering and development of curricula for MSC. and PhD study as well as continuing education.

- ◆ Developed /modernised of 17 subjects.
- ◆ Publishing of 3 books and preparing of 7 text - books for publishing.
- ◆ Building up the training center at TU Košice which consist of ATM laboratory, DSP laboratory, laboratory of VLSI processors and laboratory of Electronics Circuits and Measurement.
- ◆ Exchange of 4 student and PhD students at EU partners universities.
- ◆ All goals of the project has been fullfil and project has created a very efficient platform for extension of the cooperation between EU and Slovak Universities. From point of view TU and FEEI Košice project has created very good condition for development of degree course Telecommunication technology at TU Košice and for good cooperation with other Slovak Universities in the field of education.

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: Jozef Zavacký, Iveta Gladišová, Martin Dulina, Ján Fedor, Rastislav Labovský, Igor Kuba, Martin Kapinos, Jozef Dzivý, Le Hoang Lien Son

Scientific goals/research targets:

- ◆ Digital image coding with very low bit rate.

Results Achieved:

- ◆ New modifications of multistage vector quantization of images by using the optimum non-linear interpolation in domain of two-dimensional discrete cosin-transform.
- ◆ The proposed generic algorithm of lattice vector quantization employing generation of the Voronoi cells.
- ◆ For subband image coding the analysis / synthesis system has been designed on the basis of the bank of cosin-modulated filters with perfect reconstruction.
- ◆ Finally a multigrid motion estimation algorithm for videocodecs.

Title of the Project: *Study of fuzzy structures represented by neural networks and statistical sensors*

Funding: VEGA, 1/3207/96

Duration: 1996 – 1998

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

Group members: Viktor Pirč, Viktor Špány, Ján Šaliga, Pavol Galajda, Vladislav Sedlák, Pavol Mikulík, Gabriel Hanko, Alena Galajdová

Research activity of the group is concentrated on:

- ◆ Statistical sensors.
- ◆ Application of neural networks in instrumentation.

Scientific goals/research targets:

The common project goal is the study of non-linear fuzzy systems, which are dedicated for measuring tasks.:

- ◆ 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. Its mathematical model allows to study the presence of the local minimal in the state space representation and determination of the conditions for the suppression of the "spurious solutions".
- ◆ 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.

Results Achieved:

- ◆ The signal recognition carrying useful information by two independent parameters of their form. The proposed approach was tested for the case of exponential pulses identification and the dual tone multifrequency decoder for telecommunication purpose. 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 analog 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 analog neural structure.

- ◆ The stochastic 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: Ľuboš Ovseník, Marian Mihok, Peter Marenčák, Martin Benčo

Scientific goals/research targets:

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

Results Achieved:

- ◆ Many commercial, scientific and educational environments face the communications bottleneck resulting from the limited transmission speed of today's interconnect technologies. Medical centers and hospitals would be able to transmit images from magnetic resonance scans to hundreds of workstations simultaneously.
- ◆ Universities, research centers and large corporations all need to link their mainframes, minicomputers, workstations and PC, to high speed networks over campuses. In other areas, users do not need to share computing power, but they do need access to central mass storage in the form of large, redundant disk arrays.
- ◆ Potential network architectures are analysed and modelled with the applications in multimedia communications electrical power industry and digital image transmission.

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: Ľuboš Ovseník, Juraj Futo, Peter Marenčák, Martin Benčo

Scientific goals/research targets:

- ◆ Rapid transform (RT) and others fast translation invariant transforms (CT) are very attractive for many digital image classifications problems.
- ◆ Application GMDH algorithms.

Results Achieved:

- ◆ Rapid transform (RT) and others fast translation invariant transforms (CT) are very attractive for many digitals image classification problems. They belong to a special class of non-linear transforms with a fast computing graph. As a consequence the transforms have a very simple and fast hardware realisation. Although the RT is a non-linear and thus non-invertible, adding to the RT transform process a binary coding process (i.e. computing so called coding matrix (CM)) one may obtain the original signal (one, or two-dimensional) from its RT spectrum coefficients.
- ◆ Our research group has a long time, more than 10 years, history of research into RT or CT. We discovered RT-I, new fast translation invariant transform NT and new methods for they evaluation, computation and theoretical analysis. We have one patent on a very fast RT processor (RTP). It is intended that the result of this study will be new methods of effective signal (picture) coding and the use of RT and RT -I in image sequence coding.
- ◆ In TV picture sequence there is a high degree of correlation between successive frames, and interframe coding makes use of the redundancy to reduce the information to be transmitted. The motion compensation can be used to overcome the difficulty of significant movement. For motion estimation will be studied the application of RT-I and other transform methods.
- ◆ New 3D-object recognition system studied in this project is based on the analysis of acoustic waves reflected by the objects. The reflected signals are analysed in the time - invariant RT transform domain and compared wit reference patterns stored in memory. The applications of fast shift - invariant RT in signal classification increase the capability of the system to distinguish and identify different objects.

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: Ján Gamec, Ľuboš Ovseník, Peter Marenčák, Martin Benčo

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 signal processor Motorola DSP5600X
Laboratory of Measurement	Special measurement system
Laboratory of Microcontrolers 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
Technical Testing Institute Piešťany	COPERNICUS

International Co-operation

<i>Institution</i>	<i>Type of activity</i>
Alcatel SEL Stuttgart	TEMPUS
Siemens Viena	TEMPUS
UPC Barcelona	TEMPUS
Polztecnico di Torino	TEMPUS
Loracom France Nancy	INCO/COPERNICUS
University of Catania Italy	INCO/COPERNICUS
University of Mining and Mettalogry Krakow	INCO/COPERNICUS
MEDAV GmbH Germany	COPERNICUS
Technical University Ilmenau Germany	COPERNICUS
Technical University Liberec	COPERNICUS
LIAZ a.s. Jablonec nad Nisou	COPERNICUS
Škoda a.s.	COPERNICUS
Technical University Budapest	COPERNICUS
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
University of Calabria Italy	TEMPUS

9. FACULTY ESSAYS

Čižmár Anton

Associated professor

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

Doboš Ľubomír

Assistant 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

Assistant professor

His research interests include neural networks, nonlinear digital filters for image processing, digital signal processors and microcontrollers.

Galajda Pavol

Assistant professor

His present fields of interest are multiple - valued logic systems and its application, VLSI multiple - valued memory design and smart sensors, dynamic properties of a multiple-valued sequential circuit.

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

Assistant professor

His research interests are in the application of various signal processing methods in pitch detection and tracking algorithms for speech and audio.

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 nonlinear time-invariant and adaptive digital filters, higher-order spectra and psychoacoustics.

Levický Dušan*Full professor*

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

Maceková Ľudmila*Research assistant*

Her general research interest includes design and implementation algorithms for two and three dimensional median 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 include digital picture processing.

Michaeli Linus*Full professor*

His research interests are the preprocessing systems in the instrumentation, modeling 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. Ph.D. STUDENTS

<i>Name</i>	<i>Supervisor</i>	<i>Degree Course</i>
First 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
Second year of study		
Rudolf Zetík	Kocur	Electronics
Csaba Stupák	Marchevský	Electronics
Marek Čandík	Levický	Telecommunications
Bohumír Jelinek	Čižmár	Telecommunications
Roman Palitefka	Čižmár	Telecommunications
Vladislav Sedlák	Michaeli	Measurement technique
Miroslav Žirko (df)	Čižmár	Telecommunications
Alena Galajdová (df.)	Michaeli	Measurement technique
Third year of study		
Imrich Hendel	Kocur	Electronics
Radoslav Stanko	Kocur	Electronics
Ladislav Mihalčík (df.)	Marchevský	Electronics
Pavol Mikulík (df.)	Michaeli	Measurement technique
Ján Fedor (df.)	Mihalík	Telecommunications
Fourth year of study		
Martin Dulina	Mihalík	Telecommunications
Ľuboš Ovseník (df.)	Turán	Electronics
Gabriel Hanko (df.)	Michaeli	Measurement technique
Juraj Futó (df.)	Turán	Electronics
Fifth year of study		
Ľudmila Maceková (df.)	Marchevský	Telecommunications

11. MEMBERS

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

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.

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, Member of Technical Standardization Commission No. 55 for Electroacoustics and Ultrasound in Slovakia.

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, Member of the Scientific Board Slovak Institute of Metrology, Bratislava.

Michaeli Linus, Member 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, Member of Scientific Commission for Electronics and Informatics, Slovak Academy of Sciences.

Turán Ján, Senior Member of the IEEE.

Turán Ján, Member of Czech and Slovak Radioelectronics Society.

Turán Ján, Member of Czech and Slovak Photonics Society.

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

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

Turán Ján, Vice-president of SAPTU, TU Košice.

12. PUBLICATION ACTIVITY OF THE DEPARTMENT

Books:

- [1] Oravec,M.-Polec,J.-Marchevský,S. a kol.: Neurónové siete pre číslicové spracovanie signálov. (Neural Network for Digital Signal Processing). Faber, Bratislava,1998.

Journal Papers:

- [1] Cennamo,P.-Daponte,P.-Michaeli,L.: Introduction to special issue on ADC modeling and testing. Computer Standards & Interfaces, Elsevier Science, Amsterdam, No.19, 1998, 169-171.
- [2] Čižmár,A.-Doboš,L.-Palitefka,R.: The Wireless ATM Architecture. Radioengineering, Vol.7, No.2, Jun 1998, 21-24.
- [3] Daponte,P.-Grimaldi,D.-Michaeli,L.: Design method of analog neural networks for pre-processing in measurement sensors. Journal of the International Measurement Confederation IMEKO, Vol.24, No 2,September 1998,pp.109-118.
- [4] Kocur,D-Hendel,M.: Adaptive Microstatic Volterra Filters. Journal Electrical Engineering, Vol.49 (1998), NO.9-10, 225-231.
- [5] Kocur,D.-Stanko,R.: Polyspectral analysis of signals : An Introduction. Radio-engineering, Vol.7 No.2, Jun 1998, 15-20.
- [6] Turán,J.-Mihok,M.: Multiplex in optically powered sensor telemetry system. Journal of Electrical Engineering, Electr. Journal, No.1-2, 1998, 37-40.

Conference Papers

- [1] Čižmár,A.-Doboš,L.-Palitefka,R.: Multimedia Services over ATM Network. Proceedings RSEE 98. Oradea, May 27-29, 1998.
- [2] Čižmár,A.-Krokavec,D.: Continuous Speech Recognition over the Telephone (COST project No 249). I. Internal Scientific Conference of the Faculty of Electrical Engineering and Informatics, Košice, Slovak Republic, February 5, 31-32.
- [3] Čižmár,A.-Levický,D.: Isman integrated services metropolitan area network (Copernicus Project no 587). I. Internal Scientific Conference of the Faculty of Electrical Engineering and Informatics, Košice, Slovak Republic, February 5, 33-34.
- [4] Čižmár,A.-Levický,D.: Mocomtel mobile computing for telematic services (INCO/Copernicus project No PL 961114). Internal Scientific Conference of the Faculty of Electrical Engineering and Informatics, Košice, Slovak Republic, February 5, 35-36.

- [5] Čižmár,A.: Management of man and wan broadband networks. Internal Scientific Conference of the faculty of Electrical Engineering and Informatics, Košice, Slovak Republic, February 5, 37-38.
- [6] Čižmár,A.-Doboš,L.-Juhár,J.: Multimedia Services over ATM network. Proceedings of 4th International TEMPUS TELECOMNET Workshop July7, 1998, Barcelona, 82-85.
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- [9] Doboš,L.-Čižmár,A.: Future Public Land Mobile Telecommunications System. Proceedings of 4th International TEMPUS TELECOMNET Workshop July 7, 1998, Barcelona, 94-99.
- [10] Doboš,L.-Čižmár,A.-Palitefka,R: Next Generation Mobile Communications. Proc. RSEE 98, Oradea, Romania, May 27-29, 1998, 78-83.
- [11] Drutarovský,M.: Polyphase Order Analysis based on Convolution Approach. 43. Internationals wissenschaftliches kolloquium Technische Universitat Ilmenau, Thuringen, September 21-24, 1998, 393-398.
- [12] Drutarovský,M.: An Overview of DSP Programming. Proceedings of the 9th Copernicus Workshop of Innovative Methods of Noise and Vibration Analysis on Rotating Machinery for Purpose of Quality Control, Monitoring and Diagnostics, Uttenreuth, Germany, June 1998, 1-3.
- [13] Dulina,M.-Mihalík,J.: Adaptívna estimácia pohybu v obraze. Vedecká konferencia, Nové smery v spracovaní signálov IV. VA Liptovský Mikuláš, 27-29 máj, 1998, 113-116.
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- [15] Fedor,J.-Mihalík,J.: Generovanie Voroneho oblasti pre mriežkové vektorové kvantovanie. Vedecká konferencia, nové smery v spracovaní signálov IV. VA Liptovský Mikuláš, 27-29 máj, 1998, 109-112.
- [16] Galajda,P.: Non-linear system applied in the circuit theory. Proceedings of 4th International TEMPUS TELECOMNET Workshop July 7, 1998, Barcelona, 135-139.
- [17] Galajda,P.-Galajda,P.jun.: The Combination of the Methods of Superposition and Transformation with the Graphical Solution in Engineering Boundary Value

- Problems. International Conference of Mathematics Dedicated to the 75th jubilee of Prof. L.D.Kudryavtsev, TOM II, Moscow, Russia, March 1998, 35-41.
- [18] Juhár,J.: Audio coding based on psychoacoustic principles of human perception. Proceedings of 4th International TEMPUS TELECOMNET Workshop July 7, 1998, Barcelona, 144-149.
- [19] Juhár,J.-Čižmár,A.-Levický,D.: About Phonetic Transcription of Spoken Slovak. COST 249, Technical Annex, Presentations of the 249 meeting in London (UK) on 8 and October 1996, 1-12.
- [20] Kocur,D.-Stanko,R.: Order Bispectrum. 8th International Czech-Slovak Scientific Conference „RADIOELEKTRONIKA 98“, 28-29 April, 1998, Brno, 180-183.
- [21] Kocur,D.-Hendel,I.: BCC Adaptive algorithm for microstatistic Volterra filters. Proceedings of 4th International TEMPUS TELECOMNET Workshop July 7, 1998, Barcelona, 86-93.
- [22] Kocur,D.-Hendel,I.: Adaptive Algorithms for Microstatistic Volterra Filters. 43. Internationales wissenschaftliches kolloquium Technische Universität Ilmenau, Thuringen, September 21-24, 1998, 485-490.
- [23] Kocur,D.-Drutarovský,M.-Galajda,P.-Marchevský,S.-Matúš,E.-Stanko,R.: Innovative methods of noise and vibration analysis on reciprocating machinery for the purpose of quality and diagnostics. Internal Scientific Conference of the Faculty of Electrical Engineering and Informatics, Košice, Slovak Republic, February 5, 39-40.
- [24] Kocur,D.-Zetík,R.: Časovo frekvenčné reprezentácie signálov. The 3rd International Conference of Development in Aviation. Košice, Slovak Republic, September 1998, 115-120.
- [25] Levický,D.-Čandík,M.: On a method of faster image reconstruction in fractal image coding. Proceedings of 4th International TEMPUS TELECOMNET Workshop July 7, 1998, Barcelona, 140-143.
- [26] Levický,D.: Multimedia communications. Infrastructure, services and technologies. Proceedings of 4th International TEMPUS TELECOMNET Workshop July 7, 1998, Barcelona, 72-76.
- [27] Levický,D.-Čandík,M.: Fraktálové kódovanie obrazov s využitím korelácií. Vedecká konferencia, Nové smery v spracovaní signálov IV. VA Liptovský Mikuláš 27-29 máj, 1998, 91-94.
- [28] Levický,D.-Čižmár,A.-Marchevský,S.-Kocur,D.: Intelligent signal processing in telecommunications. Internal Scientific Conference of the Faculty of Electrical Engineering and Informatics, Košice, Slovak Republic, February 5, 41-42.
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- [32] Marcinek,M.-Juhár,J.-Čižmár,A.: Adaptive filtering based pitch detector. Proc. RSEE 98, Oradea, Romania, May 27-29, 1998, 144-149.
- [33] Michaeli,L.-Špány,V.-Šaliga,J.-Galajda,P.-Sedlák,V.: Methods of analogue signal interfacing into its digital representation in instrumentation. Internal Scientific Conference of the Faculty of Electrical Engineering and Informatics, Košice, Slovak Republic, February 5, 1998, 43-44.
- [34] Michaeli,L.-Levický,D.-Špány,V.-Pivka,L.-Kalakaj,P.: Autocompensative systems with flip-flop sensor. IMEKO TC-4 Technical Committee on Measurement of Electrical Quantities, ISDDMI' 98, 10th International Symposium on Development in Digital Measuring Instrumentation and 3rd Workshop on ADC Modelling and Testing, Vo I, September 17-18,1998 Faculty of Engineering, Italy, 665-668.
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- [39] Stupák,C.-: Fuzzy váhovo usporiadaný kompozičný filter. Konferencia Slovensko-Česká, Fondu J. Murgaša pre telekomunikácie, Kat. tel. FEI STU Bratislava, 25-26 máj, 1998, 14-17.
- [40] Stupák,C.-Marchevský,S.: Fuzzy kompozičné filtre pre spracovanie obrazov. Vedecká konferencia, Nové smery v spracovaní signálov IV. VA Liptovský Mikuláš, 27-29 máj, 1998, 142-145.
- [41] Šaliga,J.: Project „Internet based distributed measurement systems in education“. IMEKO TC-4 Technical Committee on Measurement of Electrical Quantities, ISDDM'98 10th International Symposium on Development in digital Measuring

- Instrumentation and 3rd Workshop on ADC Modelling and Testing Vol.I, September 17-18, 1998, Faculty of Engineering, Naples, Italy, 829-830.
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- [43] Turán,J.-Ovseník,L.-Kovesi,M.-Kovesi,L.: Development of multimedia teleeducation services. I. Internal Scientific Conference of the Faculty of Electrical Engineering and Informatics, Košice, Slovak Republic, February 5, 45-46.
- [44] Turán,J.-Ovseník,L.-Mihok,M.-Probstner,R.: Modelling fiber optics communications and sensory systems. Internal Scientific Conference of the Faculty of Electrical Engineering and Informatics, Košice, Slovak Republic, February 5, 47-48.
- [45] Turán,J.-Kovesi,M.-Gamec,J.-Ovseník,L.-Kovesi,L.: Processing of visual in intelligent communications terminals. I. Internal Scientific Conference of the Faculty of Electrical Engineering and Informatics, Košice, Slovak Republic, February 5, 49-50.
- [46] Turán,J.-Kovesi L.-Kovesi,M.: Invariant Image Memory Based on STIR Transform. Proceedings IWSSIP'98, 5th International Workshop on Systems, Signals and Image Processing. University of Zagreb Faculty of Electrical Engineering and Computing , June 3-5, 1998, Zagreb, Croatia, 90-93.
- [47] Turán,J.-Ovseník,L.: CAD System for Projecting Fibre Optics Communications Networks. 8th International Czech-Slovak Scientific Conference RADIO-ELEKTRONIKA 98" – Reprint of Presented paper, Brno, April 28-29, 317-320.
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- [54] Turán,J-Futó,J.: Multimedia Network Structures for Teleworking. ICOMT'98 Budapest, Hungary, October 28-30, 1998, 227-233.
- [55] Turán,J.-Kövesi,M.: New Method of Invariant Feature Extraction using RT and GMDH.. ICOMT'98, Budapest, Hungary, October 28-30, 1998, 91-98.
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- [57] Turán,J.-Kovesi,L.-Kovesi,M.: STIR Transform Based Invariant Image Memory Design. Proceedings of the SBT/IEEE International Telecommunication Symposium, (ITS-98), August 9-13, 1998, Maksoud Plaza Hotel, Sao Paulo, Brazil. Vol.2, 516-520.
- [58] Zavacký,J.-Mihalík,J.-Le Hoang Lien Son.: 2D – Cosine modulated filter banks. 8th International Czech – Slovak Scientific Conference „RADIOELEKTRONIKA 98“– Reprint of Presented paper, Brno, April 28-29, 404-407.
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Thesis

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- [2] Hendel,I.: Adaptívna nelineárna číslicová filtrácia (Adaptive Nonlinear Digital Filtering). Rigorous work, Košice, 1998.
- [3] Kövesi ,L.: Spracovanie obrazov pomocou RT a STIR invariantnej transformácie. (Image Processing RT and STIR invariant transform). Ph.D. dissertation, Košice, 1998.
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- [5] Matúš,E.: Použitie Waveletovej transformácie pri postupnom prenose obrazov (Using of Wavelet Transform in progressive Images Transmission). Ph.D. dissertation, Košice, 1998.
- [6] Stanko,R.: Polyspektrálna analýza diskretných signálov (Polyspectral Analysis of Discreet Signals). Rigorous work, Košice, 1998.
- [7] Zetík,R.: Časovo - spektrálna reprezentácia signálov (Time – Frequency Signal Distribution). Rigorous work, Košice, 1998.

Other publications

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For further information :

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