Name of the Institution: **Technical University of Varna**

Web: www.tu-varna.bg

Name of the TEMPUS CRH-BME representative: Jordan Kolev

BME GROUP/LABORATORY PRESENTATION

The research areas of the group comprise design and testing of specific analogue and digital integrated circuits and systems, developing and improvement of algorithms for digital signal processing and digital image processing, and developing of embedded systems with various medical and industrial applications. The research fields complement each other and allow sharing of equipment and human efforts, while pursuing the goals.

Integrated Circuit Design includes FPGA-based digital IC design, development of ASICs for medical applications, and development of modern methods of verification and testing of IC and systems. Some of the recent and current projects of the team are: FPGA based multi-sensor data transfer system for up to 128x128 input arrays, FPGA based DDS, investigation of reconfigurable digital systems in FPGA, fast acquisition of radar data using FPGA, implementation of parallel DSP algorithms in FPGA.

The research in the field of *Digital Signal Processing* is focused on hearing ability tests and speech recognition. The work on speech recognition include creating of local language speech databases, development and improving of algorithms for extraction of speech features, application of neural networks, etc. Practical applications include voice-controlled instruments and audio watermarking.

Digital Image Processing is mainly developed for biomedical applications. The team works for developing and improvement of Cone-beam Computed Tomography algorithms for image reconstruction. Approximate and exact backprojection types of algorithms are on focus. Application-specific geometrical distortion corrections are currently investigated.

The group has rich experience in design and implementation of various *Embedded Systems* based on a broad range of microprocessors and microcontrollers (Motorola, Intel, Atmel, ST, Zilog Arizona Microchip, ARM, etc.) Some applications include robot control, DAQs, sensors, process controllers, medical equipment, etc.

Field-specific equipment includes DSP kits from TI (C6000, C5000, C2000), SUN workstations, Cadence licenses, Xilinx's development platform (Spartan 3 and 6 and Virtex 4 Kits, ISE, EDK and Platform Studio, Chip Scope Pro, System Generator), Altera Cyclon, ARM-based development platforms, Sennheiser and AKG professional audio facilities, Hercules 1612 Audio Unit, etc.
General purpose instrumentation includes LeCroy's 500 MHz mixed signal oscilloscope WR6050A, Agilent's and Tektronix's arbitrary waveform generators, Agilent's programmable power supplies and digital storage oscilloscopes, National Instruments PXI system with embedded controller, multifunction DAQ and DMM modules. Soldering and de-soldering stations, toolsets, components, etc. support the prototyping and the testing activities of the group.

Embedded system SW is developed using both assembler and high level languages (C/C++). Preliminary design and simulations are performed in Matlab, LabView, C/C++ Builder, etc.

BME EDUCATION

COURSES AVAILABLE IN ENGLISH? (IF YES, ON WHICH LEVEL?)

- BSc:
- MSc: 2
- PhD: 2

ECTS: Total number

- BSc:
- MSc: 80
- PhD:

BILATERAL AGREEMENTS WITH OTHER UNIVERSITIES? (LIST THOSE UNIVERSITIES)

- University of Patras, Greece
- University of Gent, Belgium
- Tampere University of Technology, Finland

MAIN BME INTERESTS

- Hearing ability tests
- Cone-beam computed tomography imaging
- Design of medical instrumentation

ACTIVE PROJECTS

National

- "Segmentation, description and recognition of two-dimensional signals", financed by TU-Varna, 2009-2010

International

- Combinatorial synthesis of peptide arrays with a laser printer (PEPLASER), 223243, FP7-HEALTH-2007-B
- Curricula Reformation and Harmonisation in the field of Biomedical Engineering (CRH-BME), 144537-TEMPUS-2008-GR-JPCR

Other

- -

Patents

- -

RECENT PUBLICATIONS (LAST 2 YEARS)

1. Z. Kamarianakis, I. Buliev and N. Pallikarakis, Identification and Localization of Intramedullary Nail Holes For Orthopedic Procedures Using Cone Beam Reconstruction and Simulation techniques, World Congress on Medical Physics and Biomedical Engineering, 2009, Sep. 7-12, Munich, Germany
2. Z. Kamarianakis, I. Buliev and N. Pallikarakis, Comparison of methods for identification of oval contours on tomographic images with potential application in the image guided orthopedic surgery, 7TH European Symposium on Biomedical Engineering - ESBME 2010, Satellite event of MEDICON 2010, 28 - 29 May 2010, Porto Carras Resort – Chalkidiki, Greece
3. H. Rusev, I. Buliev and J. Kolev, System for Visually Reinforced Audiometry, XIX International Scientific Applied Science Vonference, Electronics ET2010, 22-24 September 2010, Sozopol, Bulgaria
4. Z. Kamarianakis, I. Buliev and N. Pallikarakis, Robust Identification and Localization of Intramedullary Nail Holes for Distal Locking Using CBCT: A Simulation Study, accepted for publication in Medical Engineering & Physics
5. Bekov E., Genov P., Analysis of pulse generator for PVDF ultrasound transducer for non destructive test, Acoustic, Bulgaria, 2010
6. Bekov E., Genov P., Design of volume transducer for non destructive test, Acoustic, Bulgaria, 2010.
7. Pavlova I., Hadzhidimov I., Bekov E., Silicon Sensors for Systems for

Assessment of Sun Potential, ICEST, Ohrid, Macedonia, 2010

8. Jordanov A., Balchev. B., Bekov E., Comparison Analyze for Co Energy System for Ecological Energy, National Conference Electronic, TU-Sofia, 2010

COLLABORATION WITH OTHER INSTITUTIONS (OPTIONAL)

Universities:

- University of Ruse
- Technical University of Sofia

Research Centers:

- Centre of Biomedical Engineering, Bulgarian Academy of Science

Medical Institutions:

- Medical University of Varna
- University Hospital ‘St. Marina’, Varna

Other:

- Johnson Controls Inc. (JCI) – embedded systems and software
- Zentrum Mikroelektronik Dresden (ZMD) – sensors, process simulations