Silesian University of Technology
Faculty of Automatic Control, Electronics and Computer Science

Annual Review 2012

Institute of Electronics

Akademicka 16, 44-100 Gliwice, Poland
phone: (+48) 32 2371495, (+48) 32 2371529
fax: (+48) 32 2372225, e-mail: instytut.elektroniki@polsl.pl
http://iele.polsl.pl

Edited by
Zdzisław Filus and Edward Hrynkiewicz

Prepared for printing by
Halina Delewicz

Institute of Electronics, March 2013

FOREWORD

The Institute of Electronics is a part of the Faculty of Automatic Control, Electronics and Computer Science, one of the 13 faculties of the Silesian University of Technology, founded in 1945. The University is located in Gliwice and has almost 29,000 students at present. The Faculty of Automatic Control was founded in 1964, and after a few reorganisations it changed its name to the Faculty of Automatic Control, Electronics and Computer Science. The total number of students is about 3,200 now. Since its creation in 1974 the Institute of Electronics has undergone a number of reorganisations. It has over 70 members of academic staff and consists of six divisions:

- ***Division of Electronics Fundamentals and Radio Engineering***
- ***Division of Digital and Microprocessor Systems***
- ***Division of Circuit and Signal Theory***
- ***Division of Telecommunication***
- ***Division of Biomedical Electronics***
- ***Division of Microelectronics and Nanotechnology***

The Institute specialises in such advanced fields of engineering as analogue and digital electronic systems, including biomedical systems, production of telecommunication and electronic systems etc. Research in these areas ranges from component to system level, encompassing practical and theoretical investigations with the application of both hardware and software techniques. Research groups are supported by a wide range of test and instrumentation equipment together with computer facilities, which can run with programming languages of all levels and offer various application software. Many of the Institute's research programmes are carried out in close co-operation with industry in order to satisfy the needs of the region, which is the main industrial centre of Poland.

The Institute offers 3.5-year courses leading to the degree of BSc in the general field of Electronics and Telecommunication and 1.5-year MSc courses in the following specialisations:

- Electronic Apparatus
- Biomedical Electronics
- Microelectronics
- Radio Engineering
- Telecommunication

Both degrees are obtained on the basis of a project and a report, presented during a final examination. In addition, the Institute participates in a joint macro-course in Automatic Control, Electronics and Computer Science, run by the Faculty, in which all teaching is in the English language. The courses normally consist of lectures, laboratories, seminars and projects, and are followed by examinations. The curricula of the courses run by the Institute are designed for people who want to achieve both theoretical knowledge and practical skills in electronics. Other didactic activities include postgraduate and PhD studies.

The following pages provide detailed information regarding the research carried out as well as the subjects taught in each division.

CONTENTS

FOREWORD **5**

CONTENTS **7**

DIRECTORS OF THE INSTITUTE **9**

DIVISION OF ELECTRONICS FUNDAMENTALS AND RADIO ENGINEERING **11**

DIVISION OF DIGITAL AND MICROPROCESSOR SYSTEMS **13**

DIVISION OF CIRCUIT AND SIGNAL THEORY **15**

DIVISION OF TELECOMMUNICATION **17**

DIVISION OF BIOMEDICAL ELECTRONICS **19**

DIVISION OF MICROELECTRONICS AND NANOTECHNOLOGY **21**

STATUTORY ACTIVITIES OF THE INSTITUTE OF ELECTRONICS **23**

DSc DEGREES CONFERRED ON STAFF MEMBERS OF THE INSTITUTE OF ELECTRONICS 23

PhD DEGREES CONFERRED ON STAFF MEMBERS AND PhD STUDENTS OF THE INSTITUTE OF ELECTRONICS 23

RESEARCH GRANTS 24

GRANTS AWARDED BY THE COMMISSION OF EUROPEAN COMMUNITIES 25

INDIVIDUAL RESEARCH GRANTS AWARDED BY THE MINISTRY OF SCIENCE AND HIGHER

EDUCATION TO STAFF MEMBERS OF THE INSTITUTE 26
INTERNATIONAL CO-OPERATION..... 26
SCIENTIFIC CONFERENCES ORGANISED AND CO-ORGANISED BY THE INSTITUTE OF ELECTRONICS 26
STAFF MEMBERS PARTICIPATING IN SCIENTIFIC AND ORGANISING COMMITTEES OF CONFERENCES AND SYMPOSIA..... 27
REVIEWERS..... 29
OTHER IMPORTANT AFFILIATIONS..... 32
PATENTS AND PATENT APPLICATIONS..... 35
LIBRARY RESOURCES OF THE INSTITUTE OF ELECTRONICS..... 36

LIST OF PUBLICATIONS - 2012 37

ABSTRACTS OF SELECTED RESEARCH PROJECTS51

DIVISION OF ELECTRONICS FUNDAMENTALS AND RADIO ENGINEERING..... 51
DIVISION OF DIGITAL AND MICROPROCESSOR SYSTEMS..... 54
DIVISION OF CIRCUIT AND SIGNAL THEORY 56
DIVISION OF TELECOMMUNICATION 58
DIVISION OF BIOMEDICAL ELECTRONICS..... 61
DIVISION OF MICROELECTRONICS AND NANOTECHNOLOGY..... 63

DIRECTORS OF THE INSTITUTE

Director of the Institute:
Prof. Edward HRYNKIEWICZ

Vice Director of the Institute for Research:
Prof. Zdzisław FILUS

Vice Director of the Institute for Teaching:
Asst. Prof. Jacek KONOPACKI

DIVISION OF ELECTRONICS FUNDAMENTALS AND RADIO ENGINEERING

Head of Division: Prof. Zdzisław Filus, PhD, DSc

Research staff

Prof. Zdzisław FILUS, PhD, DSc

Prof. Andrzej KARWOWSKI, PhD, DSc
Zbigniew RYMARSKI, PhD, DSc
Andrzej BŁONAROWICZ, PhD
Jacek CHĘCIŃSKI, PhD
Jerzy FIOŁKA, PhD
Zenon KIDOŃ, PhD
Adam KRISTOF, PhD
Sławomir LASOTA, PhD
Mirosław MAGNUSKI, PhD
Andrzej MALCHER, PhD
Artur NOGA, PhD
Wojciech OLIWA, PhD
Maciej SURMA, PhD
Tomasz TOPA, PhD
Grzegorz WIECZOREK, PhD
Dariusz WÓJCIK, PhD

PhD Students

Adam POPOWICZ, MSc
Krzysztof BERNACKI MSc

Research fields

- Electronic circuits synthesis
- Symbolic methods of electronic circuits analysis
- Electronic circuits for automotive applications
- Power electronic circuits
- Microprocessor-based measurement systems
- Computational electromagnetics
- Numerical modelling of radiating and scattering wire objects
- Linear antenna theory
- Electromagnetic compatibility
- Optoelectronics, Fiberoptics

Courses

- Semiconductor Devices
- Analogue Electronic Circuits
- Analogue Circuits Design
- Electronic Measurement Techniques
- Switching Circuits
- Special Semiconductor Devices and Circuits
- Materials Technology and Electronic Equipment Design
- Field and Wave Electromagnetics
- Introduction to Radiocommunication
- Radio Engineering Systems
- Fields, Waves and Antennas
- Wireless Computer Networks
- Design of Radio Electronic Devices
- High-Frequency Engineering Fundamentals
- Electromagnetic Compatibility

DIVISION OF DIGITAL AND MICROPROCESSOR SYSTEMS

Head of Division: Prof. Edward Hrynkiewicz, PhD, DSc

Research staff

Prof. Edward HRYNKIEWICZ, PhD, DSc

Prof. Andrzej HŁAWICZKA, PhD, DSc
Mirosław CHMIEL, PhD
Robert CZERWIŃSKI, PhD
Tomasz GARBOLINO, PhD
Krzysztof GUCWA, PhD
Józef KULISZ, PhD
Adam MILIK, PhD
Adam PAWLAK, PhD
Krzysztof PUCHER, PhD
Tomasz RUDNICKI, PhD
Wojciech SAKOWSKI, PhD
Dariusz STACHAŃCZYK, PhD
Krzysztof TABOREK, PhD
Bernard WYRWOŁ, PhD
Dariusz POLOK, MSc

PhD Students
Jan MOCHA, MSc
Danuta PAMUŁA, MSc

Research fields

- Testing and testability of digital systems
  - Generation of test patterns
  - I_{DDQ} testing
  - Design for testability
  - Built-in self-tests
  - Pseudorandom techniques for built-in tests for VLSI circuits and design of standard P1149 compatible chips
  - Microcomputer signature analysis
- Design of systems with programmable devices and controllers
  - Design of support software
  - Logic synthesis
  - Technology mapping in CPLDs, FPGAs and PSoCs
  - Fast operating CPU structures of programmable controllers and methods of PLC programming
  - Distributed structures of PLCs
  - PLC applications

- Embedded control system design
- Frequency multipliers based on digital techniques
- Laboratory and industrial data acquisition and control systems
  - Signal conditioning
  - Analogue-to-digital and digital-to-analogue converters with optical isolation and fibre optic transmission systems
- Multiprocessor systems
  - Pipelining and parallel processing
  - Systems with global memory and arbitration
  - Statistical analysis of performance for pipelining processing
- ASIC design
  - High level design methodologies
  - System modelling and simulation (using VHDL and Verilog)
  - IP-core design
  - Distributed design methodologies based on the Internet

Courses

- Digital Systems Fundamentals
- Design of Digital Devices
- Microprocessors Fundamentals
- Microprocessor Systems
- Reliability and Testing of Electronic Devices
- Computer Aided Design of Integrated Circuits
- Programmable Logic Devices
- Programmable Controllers

DIVISION OF CIRCUIT AND SIGNAL THEORY

Head of Division: Prof. Jerzy Rutkowski, PhD, DSc

Research staff

Prof. Jerzy RUTKOWSKI, PhD, DSc

Jacek KONOPACKI, PhD, DSc
Tomasz GOLONEK, PhD
Damian GRZECHCA, PhD
Jan MACHNIEWSKI, PhD
Katarzyna MOŚCIŃSKA, PhD
Andrzej PUŁKA, PhD
Łukasz CHRUSZCZYK, PhD
Piotr JANTOS, PhD

Research fields

- Computer-aided electronic circuits analysis and design
  - Test and diagnosis for analogue and mixed-signal electronic circuits
  - Application of sensitivity methods to the analysis and synthesis of electronic circuits
  - Modelling and simulation of digital and mixed analog-digital circuits in VHDL language
  - System level design in SystemC
  - Application of artificial intelligence methods and genetic algorithms to circuit theory and electronics
  - Common-sense reasoning modelling and application of AI techniques to circuits models generation and verification
- Digital signal processing focused on digital filters design and application
- Signal processing and basic research into neural networks (analysis, synthesis and optimisation) and their application to engineering practice
  - Application of neural networks to image processing and recognition, including texture images
  - Application of wavelet techniques to signal processing
- Web – based education

Courses

- Circuit Theory
- Systems and Signals
- Fundamentals of Electrical Engineering
- Information Theory and Coding
- Computer-Aided Design of Electronic Circuits
- Digital Signal Processing
- Biomedical Digital Signal Processing
- Neural Networks

DIVISION OF TELECOMMUNICATION

Head of Division: Asst. Prof. Jacek Izydorczyk, PhD, DSc

Research staff

Asst. Prof. Jacek IZYDORCZYK, PhD, DSc
Prof. Dariusz KANIA, PhD, DSc
Adam DUSTOR, PhD
Maria DZICZKOWSKA, PhD
Leszek DZICZKOWSKI, PhD
Grzegorz DZIWOKI, PhD
Piotr KŁOSOWSKI, PhD
Marcin KUCHARCZYK, PhD
Andrzej KUKIEŁKA, PhD
Wojciech SUŁEK, PhD
Jerzy WOJTUSZEK, PhD
Piotr ZAWADZKI, PhD

Research fields

- Digital commutation in modern telecommunication systems
  - Construction of telephone exchanges
  - Supervisory software for telephone exchanges
  - Special services (e.g. teleconferences)
  - Implementation of digital networks with integrated services (ISDN, B-ISDN, ATM)
- Application of digital signal processing to telecommunication
  - Compression of speech signal with the application of DSPs
  - Speech synthesis
  - Speech and speaker recognition
  - Application of artificial neural networks to signal processing
  - Design, testing and implementation of error correcting and modulating codes
  - Design of modern local area networks
  - Implementation and testing of new services in the Internet
  - xDSL technology
  - Efficient hardware implementation of decoder of LDPC code.
- Electromagnetic field engineering
  - Radiation and scattering of electromagnetic waves
  - Lightning protection
- Modems

Courses

- Fundamentals of Analogue and Digital Communication
- Fundamentals of Commutation
- Switching Nodes and Exchanges
- Principles of Transmission
- Communication Systems
- Signal Theory
- Information Theory and Coding
- Digital Signal Processing
- Computer-Aided Analysis of Electronic Circuits
- Digital Signal Processors (DSP)
- Neural Networks
- Computer Networks
- Internet
- Modems
- Introduction to Cryptography

DIVISION OF BIOMEDICAL ELECTRONICS

Head of Division: Prof. Jacek Łęski, PhD, DSc

Research staff

Prof. Jacek ŁĘSKI, PhD, DSc

Marian KOTAS, PhD
Ewa STRASZECKA, PhD, DSc
Robert CZABAŃSKI, PhD
Norbert HENZEL, PhD
Jerzy IHNATOWICZ, PhD
Michał JEŻEWSKI, PhD
Michał KOZIELSKI, PhD
Tomasz PANDER, PhD
Stanisław PIETRASZEK, PhD
Tomasz PRZYBYŁA, PhD

Research fields

- Biocybernetics and biomedical engineering - processing of information in medicine
  - Processing of biomedical signals
  - Image processing and analysis
  - Fuzzy sets and systems, neuro-fuzzy systems
  - Pattern recognition
  - Cybernetics
  - Computer assisted medical diagnosis
  - Hospital information systems
  - Picture archiving and communications systems
  - Medical information systems integration
  - Expert systems in medicine
  - Time-frequency analysis of biomedical signals
  - Multirate signal processing
  - Evolutionary computations
  - Artificial neural networks
  - Data mining
  - Artificial intelligence
- Design, construction and testing of electronic medical apparatus
  - Design and construction of amplifiers for biological signals and data acquisition systems co-operating with computers
  - Testing of electromedical apparatus
  - Design of electronic devices for data acquisition

Courses

- Electromedical Metrology
- X-ray and Nuclear Imaging
- Medical Information Systems
- Cybernetics
- Artificial Intelligence
- Electromedical Equipment
- Pattern Recognition
- Principles of Knowledge Engineering
- Diagnostic Imaging Systems
- Biocybernetics
- Computers in Medicine
- Diagnostic Cardiological Systems
- Computer Aided Medical Diagnosis
- Probability Theory and Mathematical Statistics
- Optimization Methods
- Bionics
- Principles of Digital Signal Processing
- Numerical Methods
- Biomedical Information Processing

DIVISION OF MICROELECTRONICS AND NANOTECHNOLOGY

Head of Division: Prof. Jacek Szuber, PhD, DSc

Research staff

Prof. Jacek SZUBER, PhD, DSc

Wojciech FILIPOWSKI, PhD
Weronika IZYDORCZYK, PhD
Piotr KOWALIK, PhD
Monika KWOKA, PhD
Jerzy ULJANOW, PhD
Krzysztof WACZYŃSKI, PhD
Edyta WRÓBEL, PhD

PhD Student
Michał SITARZ, MSc

Research fields

- Design of electronic devices for data acquisition
- Technology of doped semiconductor glasses based on organosilicon compounds
- Special hybrid circuits made in thick (thin) film technology
- Solar cells and photovoltaic systems
- Passivation of semiconductor surfaces for application in microelectronics
- Nanotechnology of transparent conductive oxides and organic semiconductors for application in photovoltaics and gas sensors

Courses

- Materials Science and Principles of Construction of Electronic Equipment
- Physics
- Solid-State Physics
- Physics of Microfabrication
- Principles of Electron Technology
- Microelectronics
- Electronic Devices, Semiconductor Structures and Circuits
- Sensors and Actuators

- Semiconductor Devices
- Thick-Film Technology
- Design of Thick/Thin-Film Circuits
- Hybrid Circuit Technology
- Hermetic Sealing
- Thin-Film Technology
- Nanotechnology in Microelectronics

STATUTORY ACTIVITIES OF THE INSTITUTE OF ELECTRONICS

DSc DEGREES CONFERRED ON STAFF MEMBERS OF THE INSTITUTE OF ELECTRONICS

1. **Marian Kotas -** DSc examination on the basis of the monograph entitled "Nonlinear projective filtering of electrocardiographic signals" took place at the Faculty of Automatic Control. Electronics and Computer Science, Silesian University of Technology on 10 July 2012.

PhD DEGREES CONFERRED ON STAFF MEMBERS AND PhD STUDENTS OF THE INSTITUTE OF ELECTRONICS

1. **Danuta Pamuła**, Arithmetics operators on GF(2^m) for cryptographics applications: performance - power consumption - security tradeoffs, PhD advisor: Prof. Edward Hrynkiewicz, 17 December 2012.

RESEARCH GRANTS

Research activities of the Institute of Electronics are mainly financed by the Ministry of Science and Higher Education within the frames of a general research programme:

- ***Development of new research areas in electronics, telecommunication and signal processing***

Apart from this, each division of the Institute carries out its own research in the following general areas, which are further subdivided into individual research projects:

Division of Electronics Fundamentals and Radio Engineering:

- *Electronic components, circuits and systems - development of measurement methods, analysis and synthesis*

Division of Digital and Microprocessor Systems:

- *Multiprocessor systems, application specific integrated circuits, programmable logic devices and systems - analysis, design and testing*

Division of Circuit and Signal Theory:

- *Computer-aided methods of analysis, synthesis and testing of electronic systems and their selected applications*

Division of Telecommunication:

- *Development of methods and applications of digital channel commutation and transmission of digital signals, theoretical and experimental methods of examination of bodies radiating and dissipating electromagnetic waves*

Division of Biomedical Electronics:

- *Acquisition and processing of biomedical information*

Division of Microelectronics and Nanotechnology:

- *Advanced technologies in microelectronics*

In total, forty-five individual research projects were completed in 2012.

GRANTS AWARDED BY THE COMMISSION OF EUROPEAN COMMUNITIES

VII Framework Programme of European Union

1. European Network on New Sensing Technologies for Air-Pollution Control and Environmental Sustanability – EuNetAir within European Cooperation in the Field of Scientific and Technical Research (COST)
Grant: OC-2011-1-9706; Period: 2011-2014
Coordination: Dr. Michele Penza, ENEA, Brindisi, Italy; National Coordination: Dr. Monika Kwoka
The project deals with the development of new sensing technologies including new materials and systems for air-pollution control and environmental sustainability. It has a form of an international network with the contribution of 12 European scientific centers from academia and industry.

2. Innovation Technology of Multifunctional Materials and Structures for Nanoelectronics, Photonics, Spintronics and Sensoric Techniques (InTechFun); Structural project within Operational Programme of Innovative Economy: POIG.01.03.01-00-159/08, Period: 2009-2013
Coordination: Prof. A. Piotrowska, Institute of Electron Technology, Warsaw, Contribution of the Institute of Electronics: Prof. J. Szuber - Head of group PSl-2
The project deals with the development of a new innovative technology of multifunctional materials and structures for nanoelectronics, photonics, spintronics and sensoric techniques. It has a form of a national network with the contribution of 6 Polish partners from academia and industry. The Institute of Electronics is responsible for 5 workpackages dealing with technology and characterization of novel materials, structures and prototypes. In 2012 several scientific tasks were realized within the new materials and new technological modules, together with the development of infrastructures for new materials characterization.

INDIVIDUAL RESEARCH GRANTS AWARDED BY THE MINISTRY OF SCIENCE AND HIGHER EDUCATION TO STAFF MEMBERS OF THE INSTITUTE

1. **Dr D. Grzechca**, Consortium "Defence", Intelligent System for Monitoring and Access Control (Project manager: Prof. Moczulski, Silesian University of Technology, The Faculty of Mechanical Engineering) (duration: 2010-2013)
2. **Prof. E. Hrynkiewicz, Dr A. Milik**, Fast reconfigurable logic controllers (duration: 13.04.2010 – 12.04.2012)
3. **Dr. T. Rudnicki**, Control algorithms for mechatronic systems of mechanical vehicles) (duration: 18.03.2010 – 17.03.2013)
4. **Dr. W. Sułek,** Nonbinary LDPC codes over GF(q) and their effective hardware decoder implementation (duration: 18.4.2011 – 17.10.2013)

INTERNATIONAL CO-OPERATION

1. University of Brescia, Italy (Prof. J. Szuber, Dr. M. Kwoka)
2. University of Tübingen, Germany (Dr. M. Kwoka)
3. University of L'Aquila, Italy (Prof. J. Szuber, Dr. M. Kwoka
4. Budapest University of Technology, Budapest, Hungary (Prof. J. Szuber)
5. California University, Department of Electrical Engineering and Computer Science, Berkeley, USA (Dr. A. Pułka)
6. Technical University of Ostrava, Department of Measurements and Control, Czech Republic (Prof. E. Hrynkiewicz)
7. TIMA Laboratory, Grenoble, Francja (Dr. D. Grzechca)
8. Université Henri Poincaré, Nancy, France (Dr. N. Henzel)
9. Université Rennes I, IriSA Lannion, France (Dr. D.Pamuła, Prof. E.Hrynkiewicz)

SCIENTIFIC CONFERENCES ORGANISED AND CO-ORGANISED BY THE INSTITUTE OF ELECTRONICS

VIII International Workshop on Semiconductor Gas Sensors – SGS2012, Cracow, 12 – 16 September 2012 (Prof. J. Szuber, Dr. M. Kwoka)

STAFF MEMBERS PARTICIPATING IN SCIENTIFIC AND ORGANISING COMMITTEES OF CONFERENCES AND SYMPOSIA

International

1. **Dr. T. Garbolino**, Steering Committee and Program Committee, 15th IEEE Symposium on Design and Diagnostics of Electronic Circuits and Systems, DDECS 2012, 18-20 April 2012, Tallin, Estonia
2. **Dr. T. Garbolino**, Program Committee, 15th Euromicro Conference on Digital System Design (DSD), 5-8 September 2012, Cesme, Izmir, Turkey
3. **Prof. E. Hrynkiewicz**, Steering Committee and Program Committee, 15th IEEE Symposium on Design and Diagnostics of Electronic Circuits and Systems, DDECS 2012, 18-20 April 2012, Tallin, Estonia
4. **Prof. E. Hrynkiewicz,** Program Committee, Programmable Devices and embedded Systems (PdeS 2012), 11th IFAC/IEEE International Conference, 23-25 May 2012, Brno, Czech Republic
5. **Prof. E. Hrynkiewicz,** Program Committee, International Conference on Signals and Electronic Systems, 18-21 September 2012, Wrocław, Poland
6. **Dr. J. Izydorczyk**, IEEE senior member, coordinator of the IEEE technical cosponsoring, The International Science Conference: Computer Networks - CN`12, 19-23 June 2012, Szczyrk, Poland
7. **Prof. A. Karwowski,** Technical Program Committee Member, 19th International Conference on Microwave, 21-23 May 2012, Warsaw, Poland
8. **Prof. A. Karwowski,** Radar and Wireless Communications MIKON-2012, May 21-23, 2012, Warsaw, Poland
9. **Prof. A. Karwowski,** International Steering Committee Member, EMC Europe 2012, 17-21 September 2012, Rome, Italy
10. **Prof. A. Karwowski,** Scientific Advisory Committee, Advanced Electromagnetics Symposium AES 2012, 16-19 April 2012, Paris, France
11. **Dr. M. Kwoka,** Chairman of Programme and Organizing Committee of the VIII International Workshop on Semiconductor Gas Sensors – SGS2012, 12-16 September 2012, Cracow, Poland

12. **Dr. A. Milik**, Program Committee, Programmable Devices and Embeded Systems (PdeS 2012), 11th IFAC/IEEE International Conference, 23-25 May 2012, Brno, Czech Republic
13. **Dr. A. Pawlak,** DSD12, Program Committee member, 15th EUROMICRO Conference on Digital System Design (DSD), 5-8 September 2012, Cesme, Izmir, Turkey
14. **Dr. A. Pawlak,** Steering Committee and Program Committee, 15th IEEE Symposium on Design and Diagnostics of Electronic Circuits and Systems, DDECS 2012, 18-20 April 2012, Tallin, Estonia
15. **Dr. A. Pawlak,** CENICS12, Program Committee member, The 5th Int. Conference on Advances in Circuits, Electronics and Micro-electronics, August 19 - 24, 2012, Rome, Italy
16. **Prof. J. Rutkowski**, Honorary Member, The International Science Conference: Computer Networks - CN`12, Szczyrk, 1-23 June 2012
17. **Prof. J. Szuber,** Chairman of VIII International Workshop on Semiconductor Gas Sensors – SGS2012, Cracow, 12-16 September 2012

National

1. **Prof. Z. Filus**, member of the Scientific Committee of 11th National Electronics Conference, 11-14 June 2012, Darłówko Wschodnie
2. **Prof. E. Hrynkiewicz,** member of the Scientific Committee of 15th National Conference Reprogrammable Digital Circuits, RUC 2012, 31 May-1 June 2012, Szczecin
3. **Prof. E. Hrynkiewicz,** member of the Scientific Committee of 11th National Electronics Conference, 11-14 June 2012, Darłówko Wschodnie
4. **Prof. E. Hrynkiewicz**, member of the Scientific Committee of Scientific Conference „Informatics – Art. Or Craft?" and Training Workshop of the Institute of Computer Science and Electronics of the Zielona Góra University, 16-17 June 2012, Przylep near Zielona Góra
5. **Prof. D. Kania**, member of the Scientific Committee of 15th National Conference Reprogrammable Digital Circuits, RUC 2012, 31 May-1 June 2012, Szczecin
6. **Prof. D. Kania**, member of the Scientific Committee of Scientific Conference „Informatics – Art. Or Craft?" and Training Workshop of the Institute of Computer Science and Electronics of the Zielona Góra University, 16-17 June 2012, Przylep near Zielona Góra

7. **Prof. A. Karwowski,** member of the Scientific Committee of National Conference on Radiocommunications, Broadcasting and Television, 14-16 May 2012, Gdansk
8. **Dr. A. Milik**, member of the Scientific Committee of 15th National Conference Reprogrammable Digital Circuits, RUC 2012, 31 May-1 June 2012, Szczecin
9. **Prof. J. Rutkowski**, member of the Scientific Committee of 11th National Electronics Conference, 11-14 June 2012, Darłówko Wschodnie
10. **Prof. J. Rutkowski**, member of the Scientific Committee of 8th Conference Databases – Applications and Systems, 29 May-1 June 2012, Ustroń
11. **Prof. J. Szuber,** member of the Scientific Committee of 12th Seminar: Surface and Thin Films Structures, PiSC 2012, 9-12 May, Szklarska Poręba
12. **Prof. J. Szuber,** member of the Scientific Committee of 12th Conference: Electronics and Optoelectronics Sensors, COE 2012, 24-27 June 2012, Karpacz

REVIEWERS

1. **Dr. R. Czabański**, International Journal of Applied Mathematics and Computer Science
2. **Dr.L Dziczkowski,** IEEE Transactions on Instrumentation and Measurement
3. **Dr. D. Grzechca**, Journal of Electronic Testing: Theory and Applications, Circuits, Systems & Signal Processing, Czech Science Foundation, Turkish Journal of Electrical Engineering & Computer Sciences, projects in the EU Operational Programme Innovative Economy 4.6, Metrology and Measurement Systems
4. **Dr. W. Filipowski**, Elektronika - Konstrukcje Technologie Zastosowania
5. **Prof. Z. Filus**, International Journal of Electronics, National Electronics Conference

6. **Dr. T. Garbolino**, Microprocessors and Microsystems, Microelectronics Reliability, Microelectronics Journal, Conferences: IEEE DDECS 2012, Euromicro DSD 2012 (special sessions)

7. **Prof. E. Hrynkiewicz**, IEEE–ICSES Conference, IEEE DDECS Symposium, IEEE-IFAC Conference on Programmable Devices and Embedded Systems, Scientific Conference „Informatics – Art or Craft?", National Electronics Conference, National Conference on Reprogrammable Digital Circuits, Metrology and Measurement Systems, Electrical Review, Springer Verlag, International Journal of Electronics and Telecommunication, Journal of Circuits, Systems and Computers

8. **Dr. J. Izydorczyk**, Physica B - Condensed Matter; PIER & JEMVA (Progress In Electromagnetics Research, Journal of Electromagnetic Waves and Applications), Micro & Nano Letters from the Institution of Engineering and Technology (IET), IEEE Transactions on Circuit and Systems I, IEEE Transactions on Magnetics, Journal of Applied Physics from American Institute of Physics (AIP), International Journal of Electronics and Telecommunications, Studia Informatica

9. **Prof. D. Kania**, Computers and Electrical Engineering, Bulletin of the Polish Academy of Sciences – Technical Sciences, International Journal of Applied Mathematics and Computer Science, International Journal of Electronics, Microprocessors and Microsystems, Multiple-Valued Logic and Soft Computing Journal, Journal of Circuits, Systems, and Computers, International Journal of Electronics and Telecommunications, Elektronika - Konstrukcje Technologie Zastosowania, Pomiary Automatyka Kontrola, Conference on Reprogrammable Digital Devices, International Conference Information Technology Interfaces

10. **Prof. A. Karwowski,** Journals: IET Proceedings Microwaves, Antennas & Propagation (London), Electronics Letters; IEEE Transactions on Antennas and Propagation; IEEE Transactions on Microwave Theory and Techniques; Progress in Electromagnetics Research, International Journal of Microwave and Wireless Technologies; COMPEL: The International Journal for Computation and Mathematics in Electrical and Electronic Engineering. Conferences: European Microwave Conference, EMC Europe, International Conference on Microwaves, Radar & Wireless Communications (MIKON)

11. **Dr. P. Kłosowski**, International Symposium on Engineering Education and Educational Technologies (EEET 2012)

12. **Dr. J. Konopacki**, Circuits, Systems and Signal Processing, Journal of Artificial Intelligence and Soft Computing Research, International Conference on Signals and Electronic Systems, International Conference on Artificial Intelligence and Soft Computing

13. **Dr. M. Kotas**, Biomedical Signal Processing and Control

14. **Prof. J. Łęski**, Medical Technology in Medical Science Monitor, IEEE Trans. Neural Networks, International Journal Applied Mathematics and Computer Sciences, IEEE Trans. Systems, Man & Cybernetics, Journal of Applied Computer Science, European Journal of Operational Research, Fuzzy Sets and Systems, Pattern Recognition Letters, IEEE Trans. Biomedical Engineering, IEEE Trans. Fuzzy Systems, Journal of Theoretical and Applied Mechanics, IEEE Trans. Signal Processing, Computational Statistics and Data Analysis, Bulletin of the Polish Academy of Sciences, BioMedical Engineering OnLine

15. **Dr. A. Noga**, Progress in Electromagnetics Research, Journal of Electromagnetic Waves and Applications

16. **Dr. T. Pander,** Computing in Cardiology 2012 Conference, Elsevier Journal: Artificial Intelligence in Medicine

17. **Dr. A. Pawlak,** reviews for The National Centre for Research and Development) projects to the program POIG, Activity 1.1 and 1.4.

18. **Dr. A. Pułka,** EU Project and Project proposals; Elsevier Journal: Information and Software Technology; IEEE Transactions on Instrumentation and Measurement

19. **Dr. Z. Rymarski**, International Journal of Electronics, IET Power Electronics

20. **Dr. E. Straszecka**, Artificial Intelligence in Medicine, Information Sciences, International Conference on Artificial Intelligence and Soft Computing 2012, Zakopane, Poland

21. **Dr. W. Sułek**, IEEE Wireless Communications and Networking

22. **Prof. J. Szuber**, Applied Surface Science, Thin Solid Films, Sensors and Actuators B, Optica Applicata, Acta Physica Polonica B, Vacuum, Electrochemical Acta, Journal of Materials Sciences, Journal of

Nanoscience and Nanotechnology, Journal of Vacuum Science and Technology A and B, Materials Science in Semiconductor Processing, Surface Science, Journal of Applied Physics, national project proposals founded by Ministry of Science and Higher Education, and National Science Centre

23. **Dr. T. Topa**, International Journal of Numerical Modelling: Electronic Networks, Devices and Fields, IEEE Antennas and Wireless Propagation Letters

24. **Dr. D. Wójcik**, Progress in Electromagnetics Research, Journal of Electromagnetic Waves and Applications

25. **Dr. P. Zawadzki**, International Journal of Applied Mathematics and Computer Science, Quantum Information & Computation

OTHER IMPORTANT AFFILIATIONS

1. **Prof. Z. Filus**, member of the Institute of Electrical and Electronics Engineers (IEEE)

2. **Prof. Z.Filus**, member of the section Electronics at the Katowice Branch of the Polish Academy of Sciences

3. **Prof. Z. Filus**, Section on Signals, Circuits and Systems of the Electronics and Telecommunication Committee, Polish Academy of Sciences

4. **Dr. D.Grzechca**, Senior Member of the Institute of Electrical and Electronics Engineers (IEEE)

5. **Dr. J. Izydorczyk**, Senior Member of the Institute of Electrical and Electronics Engineers (IEEE)

6. **Dr. J. Izydorczyk**, member of the section Electronics at the Katowice Branch of the Polish Academy of Sciences

7. **Dr. P. Kłosowski**, member of the section Electronics at the Katowice Branch of the Polish Academy of Sciences

8. **Prof. D. Kania**, member of the section Electronics at the Katowice Branch of the Polish Academy of Sciences

9. **Prof. D. Kania**, Section on Signals, Circuits and Systems of the Electronics and Telecommunication Committee, Polish Academy of Sciences

10. **Prof. E. Hrynkiewicz**, member of the Institute of Electrical and Electronics Engineers (IEEE)
11. **Prof. E. Hrynkiewicz**, member of the Electronics and Telecommunication Committee of Polish Academy of Sciences
12. **Prof. E. Hrynkiewicz**, member of the Steering Committee of the Polish Society of Measurements, Automatic Control and Robotics
13. **Prof. E. Hrynkiewicz**, chairman of the section Electronics at the Katowice Branch of the Polish Academy of Sciences
14. **Prof. E. Hrynkiewicz**, Section on Signals, Circuits and Systems of the Electronics and Telecommunication Committee, Polish Academy of Sciences
15. **Prof. E. Hrynkiewicz**, member of Microelectronics Section of the Electronics and Telecommunication Committee, Polish Academy of Sciences
16. **Prof. A. Karwowski**, member of the International Steering Committee of EMC Europe - International Symposia and Workshops on Electromagnetic Compatibility
17. **Prof. A. Karwowski**, member of the Electromagnetic Compatibility Section, Electronics and Telecommunication Committee, Polish Academy of Sciences
18. **Prof. A. Karwowski**, member of the Microwave Section, Electronics and Telecommunication Committee, Polish Academy of Sciences
19. **Prof. A. Karwowski**, member, Editorial Board, Radioengineering
20. **Prof. A. Karwowski**, member substitute, Management Committee, Action IC1102, European Cooperation in Science and Technology (COST)
21. **Prof. A. Karwowski**, Chairman, Commission A, URSI National Committee
22. **Prof. A. Karwowski**, Senior Member of the Institute of Electrical and Electronics Engineers (IEEE)
23. **Dr. J. Konopacki**, secretary of the Electronics section at the Katowice Branch of the Polish Academy of Sciences
24. **Dr. M. Kucharczyk**, Vice-Chairman of Computer Society Chapter, Poland Section IEEE

25. **Prof. J. Łęski**, member of the division Fuzzy Logic and Neural Networks at the section Automatics and Robotics of the Polish Academy of Sciences
26. **Prof. J. Łęski**, member of the Polish Biomedical Engineering Society
27. **Prof. J. Łęski**, member of the Scientific Committee of the Biomedical Engineering Centre
28. **Prof. J. Łęski**, member of the Scientific Committee of the Institute of Medical Technology and Equipment
29. **Prof. J. Łęski**, member of the section Electronics at the Katowice Branch of the Polish Academy of Sciences
30. **Prof. J. Łęski**, member of the Steering Committee at the Gliwice-Opole Branch of the Polish Society of Theoretical and Applied Electrotechnics
31. **Prof. J. Łęski**, Senior Member of the Institute of Electrical and Electronics Engineers (IEEE)
32. **Dr. A. Milik**, member of the section Electronics at the Katowice Branch of the Polish Academy of Sciences
33. **Dr. A. Pawlak**, member of IFIP (International Federation for Information Processing) W.G. 10.5 "Electronic Systems Description and Design Tools"
34. **Dr. A. Pawlak**, member of SOCOLNET (Society of Collaborative Networks)
35. **Dr. A. Pawlak,** IFIP (International Federation for Information Processing)
36. **Dr. A. Pawlak**, correspondent of Poland, member EUROMICRO (European Association for Microprocessing and Microprogramming
37. **Prof. J. Rutkowski**, member of Adminstrative Council SEFI
38. **Prof. J. Rutkowski**, member of the Section on Signals, Circuits and Systems of the Electronics and Telecommunication Committee, Polish Academy of Sciences
39. **Prof. J. Rutkowski**, Microelectronics Section of the Electronics and Telecommunication Committee, Polish Academy of Sciences

40. **Prof. J. Rutkowski**, Steering Committee member of the Electronics and Telecommunication Panel of the Polish Academy of Sciences

41. **Prof. J. Szuber**, member of the Steering Committee of the International Society on Olfaction and Chemical Sensing for the period 2009-2012

42. **Prof. J. Szuber**, Alternate Councillor of the International Union of Vacuum Science, Technology and Application for the period 2010-2013

43. **Prof. J. Szuber**, International Union on Vacuum Science, Technology and Application (IUVSTA), representative of the Polish Vacuum Society

44. **Prof. J. Szuber**, President of the Polish Vacuum Society for the period 2010-2013

45. **Prof. J. Szuber**, coordinator of research centers and networks: CESIS, NANOMET, GOSPEL

46. **Prof. J. Szuber**, member of the section Electronics at the Katowice Branch of the Polish Academy of Sciences

PATENTS AND PATENT APPLICATIONS

Mirosław Magnuski (PhD), Patent No 212923 of 12 July 2012, "A method and microwave test set for measurements of amplitudes and phase angle of scattering waves or correlation coefficient of noise waves"

Moczulski W., Kuś W., **Grzechca D**., **Golonek T**., **Chruszczyk Ł**., **Wójcik D**., **Surma M**., **Fiołka J**., Kyzioł P., Cyran K., Antemijczuk O., Baron G., Czekalski P., Paduch J., Tokarz K., Wyleżoł M., Patent application No. 393025 of 4 June 2012, "A system and method of authorized monitoring of presence within a large protected area"

Grzegorz Wieczorek (PhD), Patent No. PL212100 of 31 August 2012, "A method and a device for measurement of parameters of stochastic and deterministic harmonic signals"

Grzegorz Wieczorek (PhD), Patent application No. P-397932 of 30 January 2012, "A method and apparatus for remote distance measurement"

LIBRARY RESOURCES OF THE INSTITUTE OF ELECTRONICS

Total number of book titles	6610
Number of subscribed national journals	5
Number of subscribed foreign journals	5

LIST OF PUBLICATIONS - 2012

1. **Bernacki K**., **Noga A**., Numerical and experimental analysis of radiated emissions from different heat sink configurations, 22nd International Conference Radioelektronika 2012 Brno, Czech Republic, 17-18 April 2012
2. **Bernacki K**., **Noga A**., Woźnica T., Analysis of the electromagnetic fields radiated by electronic systems with heatsinks, Telecommunication Review & Telecommunication News, No. 4/2012, pp. 273-275
3. Blacha A., Koscielniak P., **Sitarz** M., **Szuber J**., Zak J., Pedot brushes electrochemically synthesized on thienyl-modified glassy carbon surfaces, Electrochimica Acta No.62 (2012), pp. 441-6
4. **Chęciński J**., **Filus Z**., PWM controlled LED lamps as a disturbance source to infrared systems, Elektronika - Konstrukcje Technologie Zastosowania, No. 10, 2012, pp. 33-36 (reprint from the 11th National Electronics Conference, KKE'2012, Darłówko Wschodnie, 11-14 June 2012)
5. **Chmiel M**., **Hrynkiewicz E**., The Dynamic Properties Investigation of the PLC CPU Implemented in FPGA, Proceedings of 11th IFAC/IEEE International Conference on Programmable Devices and Embedded Systems, PDeS'12, Brno, Czech Republic, 23-25 May 2012, pp. 126-131
6. **Czabański R**., **Jeżewski M**., Jeżewski J., Wróbel J., Horoba K., Robust extraction of fuzzy rules with artificial neural network based on fuzzy inference system. International Journal of Intelligent Information and Database Systems, Vol. 6, No. 1, 2012, pp. 77-92
7. **Czabański R**., Jeżewski J., Matonia A., **Jeżewski M**., Computerized Analysis of Fetal Heart Rate Signals as the Predictor of Neonatal Acidemia, Expert Systems with Applications, Vol. 39(15), 2012, pp. 11846–11860
8. **Czabański R**., Wróbel J., Jezewski J., **Jezewski M**., Two-Step Analysis of the Fetal Heart Rate Signal as a Predictor of Distress,

Lecture Notes in Computer Science, Vol. 7197, Springer Verlag, 2012, pp. 431-438

9. **Czerwiński R**., **Kania D**., Area and speed oriented synthesis of FSMs for PAL-based CPLDs, Microprocessors and Microsystems, Vol. 36, Issue 1, February 2012, pp. 45–61

10. Domagalska M., Szopa A., **Kidoń Z**., **Pietraszek S**., Wodarska M., The clinical evaluation of spasticity , Physiotherapy. Pressing issues of everyday practice. Eds.: J. Witkoś, B. Błońska-Fajfrowska, L. Niebrój, T. Gaździk. Raleigh: Lulu Enterprises, Inc., 2012, pp. 121-129

11. **Dustor A**., **Kukiełka A**., Voice Activity Detection for Speaker Recognition, 35th International Conference on Fundamentals of Electrotechnics and Circuit Theory, IC-SPETO, Ustroń, Poland, 23-26 May, 2012, pp. 79-80

12. **Dziczkowski L**., Żółkiewski S., Determination of the penetration depth of eddy currents in defectoscopic tests, 5 International Congress on Technical Diagnostics, Cracow, 3-5 September 2012, p. 138

13. **Dziwoki G**., An analysis of the unsupervised phase correction method in quadrature amplitude modulation systems, Przegląd Elektrotechniczny, Vol.88, No. 7a, 2012, pp. 245–249

14. **Dziwoki G**., Local minima elimination in blind phase correction of 16-QAM signals, 35th International Conference on Fundamentals of Electrotechnics and Circuit Theory, IC-SPETO, Gliwice-Ustroń, Poland, 23-26 May 2012, pp. 141-142

15. Golly Ł., **Pułka A**., Multitask Real-Time Systems Modeling in SystemC. Proceedings of IEEE International Conference on Signals and Electronic Systems, ICSES 2012, Wrocław, Poland 18-21 September 2012

16. **Golonek T**., **Jantos P**., Automated Method for Passive Filters Design Based on Evolutionary Computations and Monte Carlo Analysis, International Conference on Signals and Electronic Systems, ICSES 2012, Wrocław, Poland, 18-21 September 2012, (CD edition)

17. **Golonek T**., **Jantos P**., The use of Walsh-Hadamard Transform for Analog Electronic Circuits Testing, 11th National Electronics Conference, Darłówko Wschodnie, 11-14 June 2012, pp. 182-187 (CD edition)

18. **Golonek T**., **Jantos P**., **Rutkowski J**., Stimulus with limited band optimization for analogue circuit testing, Metrology and Measurement Systems, vol. 19, No. 1/2012, pp. 73-84

19. Grządziel L., Krzywiecki M., Peissert H., Chasse Th., **Szuber J**., Photoemission study of the Si(111)-native SiO2/copper phthalocyanine (CuPc) ultrathin film interface, Organic Electronics, No. 13 (2012) pp. 1873-80

20. **Grzechca D**., The design of PWL excitation with use of SA algorithm and neural network fitness function, National Electronics Conference, Darłówko Wschodnie, 11-14 June 2012, (CD edition)

21. **Grzechca D**., Biolik B., **Chruszczyk Ł**., **Golonek T**., **Fiołka J**., Indoor location based on the signal fusion – mobile device and base station for 433 MHz band, 3rd International Conference on Indoor Positioning and Indoor Navigation (IPIN), Sydney, Australia, 13–15 November 2012, (CD edition)

22. **Grzechca D**., **Chruszczyk Ł**., **Golonek T**., Low-cost single-chip GPS receivers' efficiency for personal identification device, 1st International Conference on Information Technology and Computer Networks (ITCN), Wien, Austria, 10–12 November 2012, pp. 90–94

23. **Gucwa K**., On Simulation of Multiplexed Architecture for Fault-tolerant Nanoelectronic Systems, Proceedings of IEEE 12th International Conference on Nanotechnology - IEEE NANO 2012, Birmingham, UK, 20-23 August 2012, pp. 679-682 (CD-ROM)

24. **Hrynkiewicz E**., **Chmiel M**., Programmable Logic Controller - Basic Structure and Idea of Programming, Przegląd Elektrotechniczny (Electrical Review), Vol.88 No. 11b/2012, pp .98-101 (reprint from the 11th National Electronics Conference, KKE'2012, Darłówko Wschodnie, 11-14 June 2012)

25. **Hrynkiewicz E**., **Chmiel M**., About Programmable Logic Controller - step by step, Przegląd Elektrotechniczny (Electrical Review), Vol. 88 No. 9a/2012, pp.303-307

26. **Izydorczyk W**., **Izydorczyk J**., Mazurkiewicz J., **Magnuski M**., **Uljanow J**., Electrical characterization of 1D SnO2 nanowires, 12th IEEE Conference on Nanotechnology. NANO'12, Birmingham, United Kingdom, 20-23 August 2012. Piscataway: Institute of Electrical and Electronics Engineers, 2012, pp. 1341–1346 (CD edition)

27. **Jantos P**., **Golonek T**., A deterministic analogue electronic circuits specification driven testing method, Elektronika - Konstrukcje, Technologie, Zastosowania, vol. 53, No. 10/2012, pp. 45-47

28. **Jantos P**., **Grzechca D**., **Rutkowski J**., Evolutionary algorithms for global parametric fault diagnosis in analogue integrated circuits, Bulletin of the Polish Academy of Science – Technical Sciences, Vol. 60, No 1/2012, pp. 133-142

29. Jeżewski J., Kupka T., Roj D., **Pander T**., **Czabański R**., **Jeżewski M**., Telemonitoring of high-risk pregnancy with quality–driven adaptation of bioelectrical signal processing, MEDSIP 2012, 5th International Conference On Medical Signal & Information Processing, Liverpool, England, 5–6 July 2012, pp. 11-12 (CD Edition)

30. Jeżewski J., Matonia A., Kupka T., Roj D., **Czabański R**., Determination of the fetal heart rate from abdominal signals: evaluation of beat-to-beat accuracy in relation to the direct fetal electrocardiogram, Biomedical Engineering, Vol. 57, No. 5, 2012, pp. 383-394

31. **Kania D**., Opara A., BDD with negative edges in logic synthesis dedicated to XOR gates, Elektronika – Konstrukcje Technologie Zastosowania, No. 2, 2012, pp. 82-85

32. **Karwowski A**., Generation of wide-band responses of electromagnetic systems from Method-of-Moments simulations, Radioelektronika, 2012, 22nd International Conference, Brno, Czech Republic, 17-18 April 2012, pp. 1-6

33. **Karwowski A**., On the convergence of adaptive bisectional frequency sampling technique combined with Stöer-Bulirsch algorithm, 19th International Conference on Microwave Radar and Wireless Communications (MIKON), Warsaw, 21-23 May 2012, Vol. 1, pp. 180-181

34. **Karwowski A**., Reconstructing wide-band system response from full-wave electromagnetic simulation by adaptive frequency sampling and implicit rational macromodeling, Przegląd Elektrotechniczny, Vol. 88, No. 12a, 2012, pp. 174-177

35. **Karwowski A**., **Noga A**., Interpolating broadband shielding behaviour of wire-grid cages from full-wave electromagnetic simulation,

International Symposium on Electromagnetic Compatibility, EMC Europe 2012, Rome, Italy September 2012

36. **Kidoń Z**., **Fiołka J**., Follow-up posturography test, Elektronika - Konstrukcje, Technologie, Zastosowania, Vol. 53, No. 9/2012, pp. 123-126

37. **Kłosowski P**. Designing specialized network devices using embedded Linux, Przegląd Telekomunikacyjny i Wiadomości Telekomunikacyjne, No. 8-9, 2012, pp. 1002-1010

38. **Kłosowski P**. Functioning and Development of Distance Education at Silesian University of Technology, Proceedings of International Conference on Engineering Education 2012 (ICEE2012), Turku, Finland, pp. 904-911

39. Komorowski D., **Pietraszek S**., **Grzechca D**., The Wireless System for EGG Signal Acquisition, 19th IEEE International Conference on Electronics, Circuits, and Systems, Seville, Spain, 9-12 December 2012, pp. 372-375

40. Kościelniak P., **Sitarz M**., Maciak E., **Szuber J**., The effect of Si substrate preparation on surface morphology and surface composition of In_2O_3 ultrathin films deposited by rheotaxial growth and vacuum oxidation, Applied Surface Science, 258 (2012), pp. 8419-24

41. Koscielniak P., **Sitarz M.**, Comini E., Maciak E., **Szuber J.,** Influence of oxidation conditions on surface composition and morphology of RGVO In_2O_3 ultrathin films, VIII International Workshop on Semiconductor Gas Sensors – SGS2012, Cracow, 12-16 September 2012, p. 53

42. **Kozielski M**., **Filipowski W**., Popowicz D., Warchal L., Density-based community identification and visualisation, 2012 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining, ASONAM, Istanbul, Turkey, 26-29 August 2012, pp. 1149-1152

43. Krzywiecki M., Grządziel L., Bodzenta J., **Szuber J**., Comparative study of surface morphology of copper phthalocyanine ultrathin films deposited on Si(111), native and RCA-cleaned substrates, Thin Solid Films, 520 (2012), pp. 3965-70

44. Kubica M., Wrona W., **Sakowski W**., Supporting Hardware Assisted Verification With Synthesizable Assertion, Proceedings of IP-SoC

2012: IP Based SoC Design Conference, Grenoble, France, 4-5 December 2012

45. **Kukiełka A**., **Dustor A**., Dual Similarity of Hybrid Connections of Active Two-Ports, 35th International Conference on Fundamentals of Electrotechnics and Circuit Theory, IC-SPETO 2012, Gliwice-Ustroń, Poland, 23-26 May 2012, pp. 53-54

46. **Kwoka M**., Koscielniak P., **Szuber J.,** Studies of surface morphology and chemistry of rheotaxial nanolayers of selected transparent conductive oxides for microelectronics application, VII Seminar: STM/AFM 2012, Zakopane, 28 November -2 December 2012, p. 24

47. **Kwoka M**., Ottaviano L., **Szuber J**., Photoemission studies of the surface electronic properties of L-CVD SnO_2 ultra thin films, Applied Surface Science, No. 258, (2012), pp. 8425-9

48. **Kwoka M., Sitarz M.**, Ottaviano L., Comini E., Zappa D., **Szuber J.**, XPS and TDS comparative studies of the surface chemistry of Ag-doped L-CVD SnO_2 ultrathin films and SnO_2 nanowires after air exposure, VIII International Workshop on Semiconductor Gas Sensors – SGS2012, Cracow, 12-16 September 2012, p. 56

49. **Lasota S**., Fast multilevel & always cancellation-free method for large electric networks exact symbolic analysis, Programmable Devices and Embedded Systems PDeS 2012, 11th IFAC/IEEE International Conference on, Brno, Czech Republic, May 2012, pp. 214 – 219

50. **Lasota S**., A New Always Cancellation-free Approach to the Multilevel Symbolic Analysis for Very Large Electric Networks, International Conference on Signals and Electronic Systems ICSES 2012, Wrocław, Poland, 18 – 21 September 2012, pp. 1 – 6

51. **Łęski J**., **Jeżewski M**., Clustering Algorithms For Classification Methods, Journal of Medical Informatics and Technologies, Vol. 20, 2012, pp. 11-18

52. **Łęski J**., **Jeżewski M**., Fuzzy clustering with prototype pairs, X Jubilee Scientific Seminar Selected Problems Of Electrotechnology and Electronics, Ustroń, Poland, 27-29 September 2012 (CD Edition)

53. **Magnuski M**., A multi-state test set for noise waves correlation matrix measurements, 11th National Electronics Conference, Darłówko Wschodnie, 11-14 June 2012, pp. 706-711 (CD edition)

54. **Malcher A**., Modified Current Differencing Transconductance Amplifier - New Versatile Active Element, 11th National Electronics Conference, KKE'2012, Darłówko Wschodnie, 11-14 June 2012, p. 69 (CD edition)

55. **Malcher A**., Falkowski P., A modified current-differencing transconductance amplifier and its applications, 11th IFAC/IEEE International Conference on Programmable Devices and Embedded Systems, PDeS, Brno, Czech Republic, 23 – 25 May 2012, pp. 206-211

56. Matonia A., Kupka T., Jeżewski J., Momot A., **Jeżewski M**., Bernyś M., Comparison of instantaneous fetal heart rate extracted from abdominal and direct fetal electrocardiograms, Journal of Medical Informatics and Technologies, Vol. 19, 2012, pp. 101-107

57. Matonia A., Kupka T., **Jeżewski M**., Roj D., Horoba K., Indirect fetal electrocardiography as an alternative method of the fetal wellbeing assessment, XXXI Congress of the Polish Gynecological Society, Katowice, Poland, 19-22 September 2012, pp. 78

58. Mazek K., **Chmiel M**., **Kulisz J**., PC based operator and diagnostic panel for Simatic S7-200 programmable controller, 11th National Electronics Conference, KKE'2012, Darłówko Wschodnie, 11-14 June 2012, pp. 266-271 (CD edition)

59. **Milik A**., LD Synthesis with Arithmetic Operations, Pomiary Automatyka Kontrola, vol. 58, No. 7, 2012, pp. 617-619

60. **Milik A**., On Mapping of DSP48 Units for Arithmetic Operation in Reconfigurable Logic Controllers, Programmable Devices and Embedded Systems PDeS 2012, 11th IFAC/IEEE International Conference on, Brno, Czech Republic, 23-25 May 2012

61. **Milik A.**, **Hrynkiewicz E**., Synthesis and implementation of reconfigurable PLC on FPGA platform, Int. J. Electron. Telecommun. Vol. 58, No. 1, 2012, pp. 85-94

62. **Mocha J**., **Kania D**., A method of hardware implementation of LD programs in FPGA devices, Pomiary Automatyka Kontrola, No. 1, 2012, pp. 88-92

63. **Mocha J**., **Kania D**., Hardware implementation of a control program in FPGA structures), Przegląd Elektrotechniczny, No. 12a, 2012, pp. 95-100

64. **Mocha J**., Woźnica T., **Wójcik** D., **Noga A**., **Surma M**., The impact of electromagnetic disturbances on the medical device, Przegląd Elektrotechniczny (Electrical Review), No. 2, 2012, pp. 42-44

65. Momot A., Wróbel J., Horoba K., **Jeżewski M**., Bernyś M., Filtering of two-dimensional digital images using weighted averaging for adaptive selection of weights, Journal of Medical Informatics and Technologies, Vol. 20, 2012, pp. 93-99

66. **Moscinska K**., **Rutkowski J**., Rethinking e-assessment in a core engineering course, Proc. IEEE Conference on Engineering Education EDUCON 2012, Marrakesh, Morocco, 17-20 April 2012, pp. 781-784

67. **Moscinska K**., **Rutkowski J**., Increasing Teaching Efficiency – Are They Ready for New Technology?, Proceedings of the IASTED International Conference Computers and Advanced Technology in Education (CATE 2012), Naples, Italy, July 25 - 27, 2012, pp. 170-176

68. **Noga A**., **Topa T**., **Karwowski A**., Using GPU accelerated version of MoM for solving scattering and radiation electromagnetic problems, 19th International Conference Microwave Radar and Wireless Communications (MIKON), Warsaw, 21-23 May 2012, Vol. 1, pp. 233-234

69. **Noga A**, **Wójcik D**., Kołodziej Ł., The circuit for demonstration of emission from printed boards, Przeglad Elektrotechniczny (Electrical Review), No. 02, 2012, pp. 20-22

70. Opara A., **Kania D**., Kubica M., The time effectiveness analysis of decomposition methods, Elektronika - Konstrukcje Technologie Zastosowania, No. 4, 2012, pp. 57-60

71. Owczarek A., Szyguła-Jurkiewicz B., Cogiel M., D. **Grzechca D.**, Weighted clustering and ROC analysis in assessment of the quality of life in patients with chronic heart failure, in „Logical, Statistical and Computer Methods in Medicine - Studies in Logic, Grammar and Rhetoric", No. 29(42), 2012, pp. 43-53

72. **Pamuła D**., **Hrynkiewicz E**., Tisserand A., Analysis of GF (2233) multipliers regarding Elliptic Curve Cryptosystem applications. 11th IFAC/IEEE International Conference on Programmable Devices and Embedded Systems Proceedings (PDeS), Brno, Czech Republic, 23-25 May 2012, pp.252-257

73. **Pamuła D**., Tisserand A., GF (2^m) Finite-Field Multipliers with Reduced Activity Variations, International Workshop on the Arithmetic of Finite Fields WAIFI 2012 Bochum, Germany, 16-19 July 2012, pp. 152-167

74. **Pander T**., **Czabański R**., **Przybyła T**., Pojda-Wilczek D., The possibilities of optokinetic nystagmus cycles averaging, Journal Medical Informatics & Technologies Conference, MIT'2012, Vol. 19, October 2012, pp.25-31

75. **Pander T.**, **Czabański R**., **Przybyła T**., Pojda-Wilczek D., Saccades detection in optokinetic nystagmus - a fuzzy approach, Journal Medical Informatics & Technologies Conference, MIT'2012, Vol. 19, October 2012, pp. 33-39

76. **Pander T**., **Czabański R**., **Przybyła T**., Jeżewski J., Pojda-Wilczek D., Wróbel J., Horoba K., Bernyś M., A New Method of Saccadic Eye Movement Detection for Optokinetic Nystagmus Analysis, 34th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC'12), San Diego, California, USA, 28 August -1 September 2012, pp. 3464-3467

77. **Pander T**., Matonia A., Wróbel J., Roj D., Jeżewski J., An application of the myriad filter for FHR baseline estimation, MEDSIP 2012, 5th International Conference On Medical Signal & Information Processing, Liverpool, England, 5–6th July 2012, (CD Edition)

78. **Pander T**., **Przybyła T**., Impulsive noise cancellation with simplified Cauchy-based p-norm filter, Signal Processing, Vol. 92, 2012, pp. 2187-2198

79. **Pruszowski Z**., **Kowalik P**. Influence of kinetics parameter of electroless nickel plating in order to optimise electrical parameters of Ni-P resistive layers, Elektronika – Konstrukcje Technologie Zastosowania, No. 9, 2012, pp. 77-78

80. **Przybyła T**., Wróbel J., **Czabański R**., Horoba K., **Pander T**., Momot M., Segmentation of biomedical signals using an unsupervised approach, Journal Medical Informatics & Technologies Conference, MIT'2012, Vol. 19, October 2012, pp. 125-131

81. **Popowicz A**., Analysis of correlated double sampling circuit with integration, Przegląd Elektrotechniczny, Vol. 88, No. 2, 2012, pp. 200-203

82. **Popowicz A**., Thermal effects during astronomical camera cooling, Przegląd Elektrotechniczny, Vol. 88, No. 12, 2012, pp. 191-192

83. **Pucher K**., **Polok D**., Implementation of universal computer interfaces that use the Mass-Storage class of the USB system, Elektronika – Konstrukcje Technologie Zastosowania, Vol. 53, No. 10, 2012, pp. 70-73

84. **Pułka A**., On Strategies for Solving of Boolean Satisfiability Problems. Proceedings of IEEE International Conference on Signals and Electronic Systems, ICSES 2012, Wrocław, Poland, September 18-21, 2012

85. **Pułka A**., **Milik A**., Measurement Aspects of the Genome Patterns Investigations, Hardware Implementation, Metrology and Measurement Systems, 19(1), 2012, pp. 49–62

86. **Pułka A**., **Milik A**., Dynamic Rescheduling of Tasks in Time Predictable Embedded Systems, Proceedings of the 11th IFAC Workshop on Programmable Devices and Embedded Systems PDeS 2012, Brno, Czech Republic, May 23-25, 2012, pp. 280–285

87. **Rudnicki T**., Operating costs of electric vehicle, Zeszyty Problemowe – Maszyny Elektryczne, No. 97/2012, pp. 49-52

88. **Rudnicki T**., Roterman A., Digital voltmeter with 22-bits MCP3550 converter, Elektronika - Konstrukcje Technologie Zastosowania, No. 10/2012, pp. 59-61

89. **Rudnicki T**., **Czerwiński R**., Absolute Encoder for the Permanent Magnet Synchronous Motor, Elektronika - Konstrukcje Technologie Zastosowania, No. 8/2012, pp. 121-124

90. **Rudnicki T**., **Czerwiński R**., Measurement of phase currents of motor with permanent magnets, Zeszyty Problemowe – Maszyny Elektryczne, No. 97/2012, pp. 57-61

91. **Rudnicki T**., **Czerwiński R**., Fręchowicz A., PMSM motor: analysis, control drivers, Pomiary Automatyka Kontrola, PAK, No. 1/2012, pp. 71-75

92. **Rutkowski J**., **Moscinska K**., From Traditional lecture to Video-Podcast based Lecture, Proceedings of the IASTED International Conference Computers and Advanced Technology in Education (CATE 2012), Naples, Italy, July 25 - 27, 2012, pp. 133-140

93. **Rymarski Z.**, Control Systems of Single-Phase Voltage Source Inverters for a UPS, Proceedings of 11-th IFAC/IEEE International Conference on Programmable Devices and Embedded Systems, PDeS 2012, Brno, Czech Republic, 23-25 May 2012, pp. 291 - 296

94. **Rymarski Z.**, The choice of the microcontroller for the voltage source inverter control in UPS systems, Elektronika - Konstrukcje Technologie, Zastosowania, No. 11/2012, pp. 111-114 (reprint from the 11th National Electronics Conference, Darłówko Wschodnie, 11-14 June 2012)

95. Seredyński R., Horoba K., Roj D., Bernyś M., **Przybyła T.**, Jeżewski J., A Routing Protocol for Wireless Network of Bedside Monitors in Fetal Surveillance System, Journal of Medical Informatics and Technologies, Vol. 21, 2012, pp. 27-33

96. **Sitarz M.**, Comini E., Zappa D., **Szuber J.,** SEM, XPS AND TDS studies of surface properties of SnO2 nanowires deposited on Ag and Au catalyst layers, VIII International Workshop on Semiconductor Gas Sensors – SGS2012, Cracow, 12-16 September 2012, p. 58

97. **Stachańczyk D.**, Using BALSA environment for the asynchronous circuits design, Przegląd Elektrotechniczny, Vol. 88, No. 11b, 2012, pp. 87-89

98. **Straszecka E.**, Uncertainty and imprecision in medical diagnosis support, Journal of Medical Informatics and Technologies, No. 19, 2012, pp. 11-22

99. **Sułek W.**, On the Overflow Problem in Finite Precision Turbo Decoding Message Passing, IEEE Transactions on Communications, Vol. 60, No. 5, 2012, pp. 1253–1259

100. **Surma M.**, **Wójcik D.**, **Fiołka J.**, Research into application of single chip transceivers in construction of sub-gigahertz radio communication devices, Telecommunication Review & Telecommunication News, No. 4/2012, pp. 248-251

101. Szczygieł Ł., **Czerwiński R.**, Classical and Doppler Ultrasonography - the basics, Ogólnopolski Przegląd Medyczny, OPM, No. 3/2012, pp. 36-42

102. Szelest M., Uzdrzychowski W., **Grzechca D.**, GNU Radio and USRP2 as a Universal Platform for Verification of Wireless Communication Devices Used in Automotive Applications, 19th Int. Conf. Mixed

Design of Integrated Circuits and Systems, Mixdes'2012, Warsaw, 24-26 May 2012, pp. 436-440

103. Szopa A., Domagalska M., **Kidoń Z.**, Kowalski I.M., **Pietraszek S**., Kiebzak W., Stępowska J., Disturbance of postural control in children with himiplegic cerebral palsy, Physiotherapy. Pressing issues of everyday practice. Eds.: J. Witkoś, B. Błońska-Fajfrowska, L. Niebrój, T. Gaździk. Raleigh: Lulu Enterprises, Inc., 2012, pp. 157-165

104. **Szuber J**., **Kwoka M**., Kościelniak P., **Sitarz M**., Optimization of technology of rheotaxial growth of thin films of selected transparent conductive oxides for gas sensors application, XII Conference: Electronics and Optoelectronics Sensors, COE 2012, Karpacz, 24-27 June 2012, p.83

105. **Szuber J., Waczynski K., Kwoka M., Sitarz M., Waczynska-Niemiec N.,** Kościelniak P., Optimization of technology of deposition of SnO_2 nanolayers by spin-coating method from the solutions, XI National Conference of Electronics, KKE 2012, Darłówko Wschodnie, 11-14 June 2012, p. 1

106. **Taborek K**., Analytical Method for Activity Description of Arbitration Circuits with Rotation of Priorities, Elektronika - Konstrukcje Technologie Zastosowania, No. 10, 2012, pp 76-78

107. **Topa T**., **Noga A**., **Karwowski A**., Using GPU accelerated version of MoM for solving scattering and radiation electromagnetic problems, 19th International Conference on Microwaves, Radar and Wireless Communications, MIKON-2012, Warsaw, Poland, 21-23 May 2012

108. **Topa T., Noga A., Karwowski A.**, Using GPU hardware acceleration for electromagnetic simulations based on the method of moments, Telecommunication Review & Telecommunication News, No. 4/2012, pp. 310-313

109. **Waczyński K., Kwoka M.**, Koscielniak P., **Sitarz M., Szuber J.**, Optimization of technology for deposition of ultrathin films of SnO_2 by spin-coating method, XII Seminar: Surface and Thin Films Structures, PiSC 2012, Szklarska Poręba, 9-12 May 2012, p. 55

110. Woźnica T., Mocha J., Badura G., **Wójcik D**., **Surma M**., The impact of EM disturbances on the commercial medical device, Przegląd Elektrotechniczny (Electrical Review), No. 12b/2012, pp. 151-154

111. **Wójcik D**., **Noga A**., Power integrity problems of printed circuit board, Przeglad Elektrotechniczny (Electrical Review), No. 02/2012, pp. 14-16

112. **Wójcik D**., **Surma M**., Low cost dual-polarized suspended microstrip antenna array for 5.8 GHz point-to-point links, 22nd International Conference Radioelektronika 2012, Brno, Czech Republic, 17-18 April 2012, pp. 179-182

113. **Wróbel E**., **Filipowski W**., **Waczyński K**., Boron doped spin-on glasses in the technology of the silicon solar cells, Elektronika – Konstrukcje Technologie Zastosowania, No. 10, 2012, pp. 31-32

114. **Wyrwoł B**., Fuzzy Logic Temperature Controller, Elektronika - Konstrukcje Technologie Zastosowania, Vol. 53, No. 10, 2012, pp. 61-63

115. **Wyrwoł B**., Hierarchical Fuzzy Logic Controller, Elektronika - Konstrukcje Technologie Zastosowania, Vol. 53, No. 10, 2012, pp. 64-66

116. **Zawadzki P**., A new view on the ping-pong protocol security, Chinese Physics Letters, Vol. 29, No. 1, 2012, pp. 010301

117. **Zawadzki P**., The Ping-Pong protocol with a prior privacy amplification, International Journal of Quantum Information, Vol. 10, No. 3, 2012, pp. 1250032

BOOKS, CHAPTERS IN BOOKS AND UNIVERSITY TEXTBOOKS

1. **Chruszczyk Ł**., Wavelet transform in fault diagnosis of analogue electronic circuits, chapter in a book: "Advances in Wavelet Theory and Their Applications in Engineering, Physics and Technology", ed. Baleanu D., InTech 2012, Croatia, ISBN 978-953-51-0494-0, pp. 197–220

2. **Garbolino T., Hławiczka A., Kulisz J., Rudnicki T., Stachańczyk D.**, Fundamentals of digital techniques - examples of examination problems, Publishers of the Silesian University of Technology, Gliwice 2012, ISBN: 978-83-7335-984-0

3. **Golonek T., Jantos P.**, Memetic Method for Passive Filters Design, chapter in InTech book: "Analog Circuits", edited by Dr. Yuping Wu, Prof. at the Institute of Microelectronics, Chinese Academy of

Sciences, China, ISBN 980-953-307-694-7, 2012, printing and online publication of the book - December 2012

4. **Grzechca D**., Hybrid methods for testing and diagnosis of analog electronic circuits – selected problems, Monograph, Publishers of the Silesian University of Technology, Gliwice 2012, 166 pages

5. **Grzechca D**., Komorowski D., **Pietraszek S**., A universal wireless device for biomedical signal recording, chapter in a book: "Pervasive, Mobile Sensing and Computing for HealthCare: Technological and Social Issues", Springer-Verlag, Berlin 2012. pp. 172-190

6. **Kania D**., Programmable Logic Devices. Logic synthesis and technology mapping methods, PWN, Warszawa 2012, 220 pages

7. **Pułka A**., Heuristic techniques in electronic systems modeling and verification. Selected problems, Monograph, Publishers of the Silesian University of Technology, Gliwice 2012

8. **Pułka A., Milik A**., Hardware Implementation of Fuzzy Default Logic, chapter in a book entitled: "Human-Computer Systems Interaction Backgrounds and Applications II" , Series: Advances in Intelligent and Soft Computing , Vol. 99, Hippe, Z. S.; Kulikowski, J. L. (Eds.), Springer Verlag 2012, ISBN: 978-3-642-23171-1, pp. 325–343

PUBLICATIONS OF THE INSTITUTE OF ELECTRONICS

1. **Filus Z., Hrynkiewicz E.**, Annual Review 2011 – Institute of Electronics, Gliwice, March 2011, 65 pages

ABSTRACTS OF SELECTED RESEARCH PROJECTS

DIVISION OF ELECTRONICS FUNDAMENTALS AND RADIO ENGINEERING

T. Topa (PhD), A. Noga (PhD), *Parallelization of the method of moments algorithms for multi-GPU and multi-core computing*

In the field of computational electromagnetics (CEM), the method of moments (MoM) has proved its great capabilities in a wide variety of far-field scattering and radiation problems involving arbitrarily shaped conducting bodies and wires. Unfortunately, the method may place a heavy burden on computer resources in terms of memory and CPU time needed to perform computations when complex large problems are analyzed. This limitation can be partially overcome by employing a parallel computing paradigm. Depending on the available hardware resources, the method can be implemented on computer clusters (message-passing parallel programming model MPI), multi-core processors (shared-memory parallel programming model OpenMP) or streaming multiprocessors (GPGPU parallel programming model). To reduce the communication overhead of MPI, thread creation overhead of OpenMP and data transfer overhead of GPGPU, these three programming models can be combined resulting in a hybrid parallel technique.

Within this research a hybrid OpenMP/CUDA technique for electromagnetic simulation of arbitrary 3D wire-grid models has been developed. The technique is used to investigate the broadband performance behaviour of radiating and scattering structures by evaluating samples of the desired observable with a uniform frequency step within the band of interest. For three Fermi-based GTX 590 CUDA-capable devices from NVIDIA used in this study, a speedup ratio of about 104x is achieved compared to the reference CPU single-threaded implementation of the MoM code. It has also been shown that: (1) the proposed hybrid OpenMP/CUDA approach performs poorly with small–scale problems owing to the OpenMP internal thread management overhead, (2) the performance is not in direct proportion to the number of employed GPUs.

A. Malcher (PhD), *Modified Current Differencing Transconductance Amplifier – A New Versatile Active Element*

Current mode active elements are commonly used in applications requiring high speed and low supply voltages. There are numerous topologies of the current mode elements – e.g. current feedback amplifiers, operational transconductance amplifiers, current conveyors and others. A few years ago a new topology called Current Differencing

Transconductance Amplifier (CDTA) appeared. This research work shows that several modifications introduced to the basic structure of the CDTA made it possible to obtain a very versatile active element.

The proposed circuit consists of a current differencing stage, a current controlled resistor and a multiple output transconductance amplifier. The parameters of each stage of the circuit can be tuned by the control currents.

In a special case the circuit can work as a fully differential current mode operational amplifier. It has been shown that most of the known voltage mode circuits based on the voltage operational amplifiers can be converted into current mode by means of the so called adjoint transformation. There are also some applications of the fully differential current mode operational amplifier, which do not have their direct voltage mode counterparts.

The most important advantage of the Modified Current Differencing Transconductance Amplifier (MCDTA) is the possibility of tuning its basic parameters: input resistances, *z* terminal resistance and transconductance by electrical signals.

It has been shown that the MCDTA circuit can be used in numerous linear and non-linear applications. The research work includes the analysis of the first order and second order current mode active filters tunable by the control current, the current controlled quadrature oscillator, rectifiers, peak detectors, sample and hold circuits, and others.

The catalogue of possible applications of this cell is very rich and is comparable to the catalogue of the configurable analog modules possible to implement in commercially available field programmable analog arrays (FPAA) from Anadigm or Cypress.

At the actual stage of this research work we can point out some disadvantages of the circuit. There can be observed a comparatively poor DC performance, which is caused by mismatching the NMOS and PMOS transistors' static characteristics. Another problem is the narrow span of the parameter changes – the conductances and transconductances of the MOS circuits are proportional to the square root of the control current, whereas in the comparable bipolar circuits they are directly proportional to the control current value. Solving these problems is the area of future research work.

Nevertheless, the MCDTA circuit, thanks to its versatility, can be used in many analog applications both as a separate component and as a basic building block of the future current mode continuous time field programmable analog array.

S. Lasota (PhD), *Symbolic analysis of large circuits with the use of the Hierarchical Parameter Decision Diagrams – application to analog circuits design*

Work on Hierarchical Parameter Decision Diagrams (HPDD) has been mainly inspired by the advantages and disadvantages of the Determinant Decision Diagrams (DDD). Unfortunately DDD is not a cancellation-free method and for large circuits the influence of the round-off error accumulation is significant. It is useless e.g. in the range arithmetic approach to the parameter dispersion problem.

The Parameter Decision Diagram (PDD), contradictory to the DDD, operates on straight parameters of components as values that are associated with vertices. The diagram can be created from the component net-list directly. The whole analysis is reduced to the manipulations on the higher order summative cofactors of an "empty" matrix. The 0- and 1-descendant for each vertex is represented by the set of pair of deletions. The only thing to do is to check if the set of deletions is admissible. Because each component can be extracted only once, the results are always cancellation-free. A result in the PDD form is slightly larger than in the DDD one, but each path from the root to the terminal vertex **1** represents one term. Thus, the PDD is a sum of products (SoP) in the compressed form, which is usually considered as the most convenient one for designers, but the least effective.

A developed version of PDD is a Hierarchical Parameter Decision Diagram (HPDD). There are 2 main reasons to apply the hierarchical approach to the analysis: 1) The circuit is naturally hierarchical – e.g. semiconductor devices can be represented by always the same small-signal model. 2) In the 1-level PDD self-similarities that come from the different instances of the same type of components can be seen. On the other hand, each well known hierarchical approach, based on some physical parameters, produces cancellations and results, which become smaller but more complex. In the HPDD approach each sub-circuit is represented by a generalized meta-vertex. There is a hidden "incomplete" piece of the PDD structure inside each meta-vertex. This piece of PDD is always cancellation-free. The meta-vertex is "incomplete", because no path is terminated with the terminal vertex **1**. They are terminated by some "leaf" described with the set of pair of deletions. "Leaves" are determined by the topology of a sub-circuit. Thus, the cancellation-free feature is preserved. For the master circuit the sub-circuit is seen as a meta-vertex with a few descendents, similarly to the genuine binary vertices.

The analysis using HPDD is distinguished by the following features:

1. The HPDD is always cancellation-free.
2. The analysis is multilevel.
3. Despite the multilevel hierarchical form, each path from the root to the terminal vertex **1** still represents a single term.
4. Each HPDD representation can be determined only once, stored in any medium (e.g. HD, "cloud") and then reused many times.
5. The creation of any master sub-circuit PDD reduces only to the testing of the influence of some just added pairs of deletion from each "leaf". Thus, the analysis of very large circuit can be fast, provided that proper partitioning of a circuit has been made.
6. The exact numerical values calculation in the *s*-Expanded form can be made fast by using multivariable sparse polynomial multiplication algorithms and can be made only once for each instance of a sub-circuit (about 50 times faster than in 1-level version).
7. Feature 3 allows fast determination of the divider and the reminder by a selected parameter (small- and large-scale sensitivities calculation, analog circuit testing).

8. Storing the numerical partial results in the operation from point 6 in the cache, allows fast simplification of results to get an approximated form that is intelligible for designers.
9. The creation of meta-vertex representation of the main circuit can be redundant, but dramatically accelerates calculation, if there are a lot of transfer functions to determine (e.g. in the weakly-nonlinear circuits analysis, or the large interconnect circuit analysis by the moment computation).

DIVISION OF DIGITAL AND MICROPROCESSOR SYSTEMS

Prof. E. Hrynkiewicz, A. Milik (PhD), Prof. D. Kania, M. Chmiel (PhD), A. Pułka (PhD), J. Mocha (MSc), *Fast and reconfigurable logic controllers*

The research area of the project covers design and implementation of efficient PLC CPUs; direct reconfigurable implementation of control programs in FPGAs; control program compilation, optimisation and synthesis. The works carried out in the domain of PLC CPU allow constructing high performance dual core bit-byte units for efficient processing of dedicated instructions. Specific peripherals that reduce computation overhead have been developed. Reconfigurable hardware implemented control algorithms are the most promising and they offer the highest computation performance. In order to obtain hardware-implemented rules, an entire set of compilation and synthesis tool chain has been developed. It consists of a compiler that transforms standard programming languages given by IEC61131-3 to an intermediate form. The developed intermediate form reveals parallelism of control tasks and allows optimising the control algorithm. The intermediate form is mapped into logic resources of the FPGA device. The use of the intermediate form generating an instruction stream for a standard PLC CPU is very promising.

D. Pamuła (PhD), Prof. E. Hrynkiewicz, Prof. A. Tisserand (IRISA, France), *Operators on GF(2^m) for cryptographic applications: performance - power consumption - security tradeoffs*

The research work was focused on securing a cryptographic system against side-channel attacks. The main attention was turned on elaborating arithmetic hardware operating modules used in elliptic curve cryptography (ECC). The main goal of research was to propose efficient and robust against power analysis side-channel attacks hardware arithmetic operators dedicated for such type of cryptography. It is necessary to mention that the work was conducted both at the Silesian University of Technology, Gliwice, Poland and at the IRISA laboratory, Lannion, France. In the work the existing algorithms for arithmetic operations in GF(2^m) and their implementations, especially implementations in FPGA, were investigated. Next the cryptanalysis techniques for breaking cryptographic systems, especially side-channel attacks, were studied. On this basis the following solutions were proposed:

- Efficient solutions for arithmetic operators on large numbers (160-600 bits) in GF(2^m) dedicated to reconfigurable hardware were proposed.
- The robustness against side-channel power analysis attacks of the designed solutions was evaluated and improved as much as possible. Power cryptanalysis aims at correlating the activity of a device under operation, represented by its power consumption, with the operations performed by the device or the values on which it is operating. To improve the robustness, to mask the arithmetic operations activity, two techniques were proposed: uniformisation of activity trace and randomisation of activity trace.
- The modifications increasing robustness of the designed hardware arithmetic operators were performed at the very low architectural (circuit) and algorithmic level and very carefully verified. Due to this their impact on the overall performance of the device is very low.

An attempt to protect the lowest level operations of ECC systems, the finite field operations, is the first known attempt of that type. The obtained results were partially published. Danuta Pamuła defended also a PhD thesis.

A. Pawlak (PhD), *Collaborative Engineering - A New Engineering Paradigm For Electronic Systems Design*

The report introduces concepts related to a new engineering paradigm, namely collaborative engineering, and more precisely - distributed collaborative engineering. Collaborative engineering encompasses methodologies, tools and design practices that are enabled by distributed design environments. It provides an effective support for collaboration in distributed, often global, virtual design teams. Collaborative design, being a part of collaborative engineering, is a central process in systems engineering that resolves dependencies between members of a virtual team and design tasks.

Problems of collaboration among virtual design team members, management, exchange and reuse of engineering knowledge based on the Internet access have been addressed in the report.

The role of new working patterns in a group of designers that are enabled by new technologies in a virtual organizations context have been pointed to. Virtual team members can belong to different organizations that realize various business models.

Cognitive issues are very relevant for design work in a distributed design team. These are sociological categories that are brought to engineering by social informatics and a discipline called CSCW (Computer Supported Collaborative Work). Regretfully, cognitive issues are seldom represented in industrial design environments.

The main aim of the report was to explain what collaborative engineering is, and what are challenges, problems and perspectives of its deployment in electronics. The first chapter aims to answer these questions. The state-of-the art in collaborative engineering has been shortly covered in the second chapter. Then infrastructures for collaborative

engineering were addressed. The last chapter explains a model-based approach to collaborative design.

T. Rudnicki (PhD), R. Czerwiński (PhD), A. Fręchowicz (PhD), *Control algorithms for mechatronic drive systems*

A combination of an economical and simultaneously environmental-friendly electric motor with a conventional internal combustion engine makes up the hybrid propulsion system that is an encouraging solution in terms of operation expenses. The work addresses control algorithms for permanent magnet synchronous motors (PMSM) with sinusoidal distribution of the electromotive force.

In order to achieve high quality of control for PMSM synchronous motors the Field Oriented Control (FOC) technique is used. It is also known as the Vector-Control Technique. These algorithms make it possible to control both rotational speed of the motor and its torque. In simple words, vector control to the PMSM motor consists in measurement of feedback signals - values of currents and voltages for the stator, angle position of the rotor - transformation of the measured values into a two-phase circuit, calculation of new values for phase voltages with simultaneous transformation into a three-phase circuit and finally, appropriate control to the power module of the inverter. The Clark and Park transformations are used to switch to the rotating coordination system (d, q). As a result from the foregoing calculations the values of currents are obtained. During the next step the already calculated values of currents together with the preset currents are supplied to PI regulators that determine new values for output voltages. These output voltage values are subjected to the reverse Park transform and, eventually, the voltages for power inverter are obtained.

The algorithm was implemented in the Texas Instruments TMS320C family DSP microcontroller. Different schemes of testing and research work were performed to develop the best solution of the hybrid drive.

DIVISION OF CIRCUIT AND SIGNAL THEORY

Prof. J. Rutkowski, D. Grzechca PhD), T. Golonek (PhD), P. Jantos (PhD), Ł. Chruszczyk (PhD), *RF circuits testing with the use of heuristic computational methods*

The main goal of the research is to design testing methodology for RF circuits with the use of heuristic computational methods. The testing method can be classified to the SDT (Specification–Driven Test) and FDT (Fault–Driven Test) groups and it is designed for the production test. The proposed technique allows to design an optimal pair of testing excitations specialized for an analog circuit diagnosis. The presented concept can be classified to the group of functional testing methods and it allows checking whether the considered specification of the circuit under test is fault–free or

not. The testing has been performed with Walsh-Hadamard transform and multi-dimensional linear regression. The circuit under test is excited by the stimuli in the time domain and the signal is acquired at the output. Coefficients for the approximating equation have been chosen by analysing the Pearson's correlation between the Walsh-Hadamard spectrums. The result is in the form of multidimensional functions, which allow building a test system using a low-cost microcontroller dedicated to the built-in electronic integrated circuit. Another task was to perform studies on using self-organizing neural networks (SOM) for parametric fault detection and localization. The circuit under test can be examined in the time and frequency domain. For the time domain testing the circuit is excited with a step function and the output responses are classified with the use of SOM network. The distribution of faults on the output map allows initial evaluation whether the circuit is damaged or fault–free. The most important conclusion flows from the neural network compression ability, which enables "raw data" analysis. The SOM network transforms a high dimension problem into a two-dimension map.

A. Pułka (PhD), *Heuristic techniques in electronic systems modelling and verification – selected problems*

The work presents a wide range of problems concerning application of heuristic methods to electronic systems modelling, verification and testing. These issues are based on the author's main achievements in the appropriate fields.

The first part of the work focuses on the applications of heuristic techniques to the methods of automated generation of models of digital and mixed signals circuits in VHDL, VHDL-AMS and SystemC languages. This part contains also descriptions of hardware models of a real-time system with heuristic time-deterministic intelligent scheduling of tasks and a system of genome searching based on dynamic programming.

The second part presents applications of heuristic methods system verification of embedded systems described in SystemC or SystemVerilog languages. The method uses UML timing diagrams. Moreover, algorithms based on FDL formalism have been shown: FUDASAT – for investigation of satisfiability of logical functions and SALTO and COSMO – for analog circuits testing. Additionally, the work presents the concept and synthesized Verilog model of hardware implementation of the inferring system based on the FDL logic. Apart from that, hardware models, implementing selected formal methods, have been presented in the form of dedicated structures.

DIVISION OF TELECOMMUNICATION

P. Zawadzki (PhD), *A computationally secure protocol for confidential key agreement in an open telecommunication channel*

Security of the contemporary and forthcoming Information and Communication Technology (ICT) systems is closely related to quantum information processing because of two reasons. First, quantum computers, if built, will introduce qualitative speed up in solving some problems. The Shor's factorization algorithm plays here a central role because it is capable to break in polynomial time the presently used key distribution and authentication schemes. Secondly, quantum indistinguishability and nature of quantum measurement permits on security paradigms derived from basic laws of physics. But construction of devices providing a purely quantum ICT system is not expected in a foreseeable future and design of protocols permitting on functional replacement of classic key agreement protocols is possible at present. A computationally secure protocol of confidential key agreement in an open telecommunication channel has been proposed as a result of the research undertaken.

The proposed solution is an improvement of the so-called Ping-Pong protocol. It is known that a protocol in lossless channels is only asymptotically secure what results and offers low eavesdropping detection probability per bit. As a matter of fact, an eavesdropper is detected with reasonable probability only for sufficiently long sequences. In effect, the protocol cannot be directly used because an eavesdropper can intercept some part of the message before he is detected. To cope with this problem, quantum processing of signal particles in blocks has been proposed. However, such solutions are not implementable with the current technology because of the requirement of the large photonic quantum memory registers. The situation is even worse in noisy environments when legitimate users tolerate some level of transmission errors and/or losses. If that level is too high compared to the quality of the quantum channel, then an eavesdropper can peek some fraction of signal particles hiding himself behind an accepted quantum bit error rate (QBER) threshold. But the possibility to intercept some part of the message without being detected renders the protocol insecurity.

The method to overcome the difficulties is the key result of the carried out investigations. The control mode which served for eavesdropping detection in seminal version is replaced in the improved protocol by the security layer built around primitives which are well known from the classic cryptography. Although the message mode alone is completely insecure, the information leakage can be avoided by proper information preprocessing. On the other hand, any eavesdropping inevitably leads to transmission errors detectable by the data integrity check. As a result, the role of the proposed layer is similar to privacy amplification known from Quantum Key Distribution (QKD) schemes, however, no information randomization is introduced and the deterministic character of communication is preserved. Although in the considered improvement the message is processed by blocks, the main advantage of the proposed approach is the elimination of quantum registers. Thus the improved protocol can be, in principle, realized in practice.

The research has resulted in a monograph, which is dedicated to issues of eddy-current conductometry. The importance of the eddy-current technology for non-destructive tests is outlined in brief with a description of properties attributable to eddy-current equipment, where particular attention is paid to conductance meters. In the same way the available reference literature is classified, with regard to types of relevant issues.

The monograph relates to the specific issues that, if resolved, shall make it possible to use an instrument that normally measures components of impedance to find out parameters of a workpiece that is examined by means of the eddy-current method. The deliberations are limited to a contact coil since that technique was deemed as the most universal one. The issues related to eddy-current measurements seem to be a hot topic due to the fact that it enables to eliminate effects of adverse factors onto measurement results for conductance or another currently measured parameter. In particular, results of conductance measurements are burdened with substantial errors caused by variable geometry of the system comprising the probe and the workpiece under measurement as well as by roughness of the workpiece.

The study has demonstrated that many of these adverse effects can be efficiently eliminated by software implementation of correcting algorithms. The revealed corrective mechanisms are associated with methods for determination of scales for measuring instruments. The most of presented ideas take advantage of the author's original finding, proved also by calculations, that any real measuring coil can be associated with a pair of equivalent parameters: r_0 and h_0. These parameters, in turn, can be determined by means of a simple experiment with the use of one reference sample. The mentioned pair of parameters unambiguously defines each coil and makes it possible to calculate how the coil impedance is altered by presence of a current-carrying material. These general formulas were developed for a model coil with all turns encapsulated by a single circle with its radius of r_0. That finding not only makes it possible to compensate the effect of coil positioning against the examined workpiece but also to conduct the sensitivity analysis, to develop scaling functions, to determine appropriate conditions for measurements and, in particular, to select such a frequency of the input current that would enable to achieve minimum errors of measurements.

The sensitivity analyses presented in this monograph and proposals how to determine scaling functions and correcting algorithms relate to various cases of measurements, including:

- conductivity and distance between the probe and the examined surface of a board,
- conductivity and distance between the probe and the examined surface of a thin plate (foil),
- thickness of a thin plate (foil) and distance between the probe and the examined surface of that foil,
- conductivity and thickness of a thin plate (foil),
- conductivity of materials used for the outer and inner layers of a two-layer (sandwich) workpiece when the thickness of the outer layer is known,

- conductivity and thickness of the outer layer deposited on a workpiece made of conductive material of known conductance.

It was demonstrated that a conductance meter provided with a microcontroller enables determination of the penetration depth of eddy currents without interruptions of measurements. For that purpose an original definition of the depth of eddy current penetration has been proposed, which is different than the generally adopted one and takes also account of metrological properties attributable to the measuring instrument.

When the method was being sought to make the result of conductance measurements independent of the surface condition, it happened that the correction factor was determined. That correction factor can be considered as the measure of surface roughness obtained by means of eddy currents. To check applicability of that approach, the measurement results were compared against the values that are generally in use in mechanical engineering.

G. Dziwoki (PhD), *An analysis of the unsupervised phase correction method in quadrature amplitude modulation systems*

Unsupervised (blind) recovery methods, applied in modern communication systems, can be a promising approach in the reception of signals which are distorted due to channel characteristics and/or absence of system synchronization. Carrier phase correction is one of the crucial tasks performed in the receiver during coherent detection of quadrature amplitude modulated (QAM) signals. The Reduced Constellation Decision Directed (RCDD) blind phase correction is a simple method that can be used for QAM constellations. The core of the method is based on the distance minimization between the sample value of the received signal and a reference symbol, both represented as points on the complex plane. The reference symbol belongs to the 4-QAM constellation and the current one is located in the same quadrant of the complex plane as the received signal sample. The simple working rule results in a possible ill-convergence towards local minima if they exist. The type of QAM constellation has crucial impact on the existence of these minima.

In order to find undesirable local minima and get a better understanding of the RCDD method properties, the performed research was focused on analytical description of the method. The analysis was complicated due to the nonlinear transfer function of the decision unit, which is responsible for the symbol reference assignment. However, symmetric properties of the constellation allowed confining the mathematical transformation to the first quadrant of the complex plane. The analytical cost function of the RCDD has a meaning of the mean square error and was derived in the case of transmission over the AWGN channel. The methodology was based on calculation of the centre of mass of signal points with associated probability density in the area of one quadrant. The numerical analysis with 16- and 32-QAM constellations proves the accordance of the analytically obtained local minima with the experimental ones. Additionally, the obtained cost function does not impose any restrictions on the probability distribution of the transmitted symbols. The analysis of the cost function

reveals two possible ways that can be used to control the local minima in an average sense. The first is to shape the probability distribution of the constellation symbols, the second is to manipulate the signal-to-noise ratio. The latter is less useful because the local minima elimination requires higher noise power that is contrary to error-free reception rule in the communication system.

DIVISION OF BIOMEDICAL ELECTRONICS

Prof. J. Łęski, M. Jeżewski (PhD), *Fuzzy clustering with pairs of prototypes*

Clustering consists in finding groups (clusters) and their centres (prototypes) of similar objects in a dataset. Clustering algorithms may be applied to classification methods, for example for determining fuzzy if-then rules parameters values. In the work the fuzzy clustering algorithm with pairs of prototypes was proposed. It is dedicated to application to classification methods. Its goal is to find pairs of prototypes – the first prototype in the first class, the second prototype in the second class. In a given class prototypes should be located near the boundary with the second class. The idea consists in separate fuzzy c-means clustering of both classes of objects but with minimization of Euclidean distances between prototypes in pairs – prototypes in pairs should move closer to each other and, as a result, they should be located near the boundary. The method is based on minimization of the criterion function. Two first components of the criterion are responsible for fuzzy c-means clustering of both classes; the third component ensures minimization of distances between prototypes in pairs. The clustering parameter determines the proportion between clustering and minimizing of distances. Final prototypes, which should be located between classes, are determined basing on the obtained pairs of prototypes. The verification of clustering results was done applying two two-dimensional benchmark datasets. In that case, an algorithm determining clustering parameter value was proposed. In the case of the first dataset most of final prototypes were located between classes, in the case of the second one some of them were not located correctly. The appropriateness of the clustering to classification methods was also verified – final prototypes were applied to nonlinear extension of the iteratively reweighted least squares linear classifier. The extension was done applying fuzzy if-then rules, rules parameters values were determined basing on the final prototypes. The classification quality achieved for six benchmark datasets was compared with the Lagrangian Support Vector Machine method. For three datasets a better result, i.e. a lower mean misclassification error was achieved.

T. Pander (PhD), T. Przybyła (PhD), R. Czabański (PhD), *The analysis of optokinetic nystagmus*

Eyes are one of the most important human organs. Their dysfunction causes difficulties in the perception of the world and greatly reduces the amount of incoming information. This significantly reduces the possibility of participating in social and occupational

functioning. One of the criteria is the ability of an acute eye view. This can be done using the Snellen table. More useful is a method based on electronystagmography (ENG) signal analysis. The essence of this research is detection and precise localization caused by rapid eye movements (saccades) in the ENG signal. Accurate detection of saccades is required for further analysis of the ENG signal.

Eyes movements generate biopotentials around eyes, which can be divided into two groups: forced eye movement (elecktrooculography, EOG) and voluntary eye movement (electronystagmography, ENG). In medicine the eye movements can be used to investigate and diagnose different diseases. The ENG signal can be applied for investigation of nystagmus. The optokinetic nystagmus (OKN) is characterized as involuntary eye movement response when a moving stimulus is presented in a large visual field. OKN is a visually driven eye movement whose purpose is to stabilize the retinal image during global movement of the visual field.

The objective of our work is to create a model of the OKN cycle. A simple linear model of the OKN cycles is applied. It requires the definition of two lines that correspond to slow and fast phase of the cycle. The slope parameters correspond to the velocity in changing the eyes position. The quasi-periodic nature of ENG signal with characteristic OKN waveforms, whose repetition rate varies over time, allows their averaging in the time domain. The signal averaging cumulates information from individual cycles of the periodic signal. The application of the arithmetic mean is the simplest method of noise reduction with a minimal risk of signal distortion and allows creating the required OKN cycle model.

The saccade detector performs nonlinear and linear filtering. The next step in the detection function is a non-linear operation and smoothing the detection function waveform. The smoothed peaks of the detection function waveform correspond to time moments when saccades appear. Any other signal components are removed, however, there are also signal peaks being the result of the eye blinks. The peaks localization in the time domain is based on looking for downward zero-crossings in the smoothed first derivative (which is now obtained on the basis of the detection function waveform) that exceeds a given slope threshold and peak amplitudes that exceed given amplitude threshold. For this purpose, a fuzzy logic method is introduced to specify the amplitude threshold. The saccade detection effectiveness is examined in the presence of an impulsive noise. For quantitative evaluation traditional indicators of quality such as true positive, false positive, false negative have been used. The results show that the proposed method of detection using fuzzy logic saccade leads to better results than the reference methods of detection.

E. Straszecka (PhD, DSc), *The basic probability assignment in the Dempster-Shafer theory as a representation of knowledge about complex diagnostic problems*

Research performed in the area of diagnosis support resulted in the conclusion that medical diagnosis support must include uncertain and imprecise information. Imprecision is typical for medical parameters. They are rarely precisely formulated (e.g.

"pregnancy") and usually described by linguistic values like "high laboratory tests results", "great appetite" or "acute pain". These values may be represented by fuzzy sets. Yet, the fuzzy set theory is not particularly suitable for modelling weights of rules. Certainty of a diagnostic rule is rather represented by probability of its use during a diagnosis. However, conditions formulated in the classical probability definition are too strict to hold true in practice. Therefore, the Dempster-Shafer theory of inference with focal elements extended for fuzzy sets is proposed for a useful representation of medical diagnostic rules. If sufficient training data are accessible, a calculation of the assignment can be done both for heuristic and for data-driven rules. Yet, sometimes several data, for instance results of expensive or hazardous examinations, are hardly available. In such a case, heuristic rules cannot be assigned by weights and membership functions of premises cannot be determined by means of data. It is possible to create them using experts' opinions, but then consistency of reasoning and updating the diagnosis support system is unreliable. Sometimes, in existing expert systems a kind of extrapolation of conclusions is applied for variable intervals that are not covered by training data. This does not seem to be a good solution too. In the present works several methods that proved useful for selected tasks of diagnosis support are analysed. They are: medical indices (Crooks' and INFARCTEST), Bayes' iterative formula used in ILIAD expert system and the certainty factor used in MYCIN expert systems. Their weak points that make them inappropriate for use in general approach to diagnosis support are pointed out. Simultaneously, a method based on the basic probability assignment determined for fuzzy focal elements is proposed. This method allows reasoning at different confidence levels, and indicates only these conclusions that are reliable for the chosen threshold of confidence. If the conclusion is not determined, a user of the diagnosis support system has to provide more data or has to perform reasoning at a lower confidence level. Thus, he/she is aware of a diagnosis hazard. This research that is described in two scientific papers is also appropriate for joining expert's knowledge with databases information. The suggested method can help to build a variety of diagnosis support tools, which become necessary nowadays, when medical knowledge extends so rapidly that it is hardly possible for a physician to follow this progress.

DIVISION OF MICROELECTRONICS AND NANOTECHNOLOGY

M. Kwoka (PhD), Prof. J. Szuber, *Photoemission studies of the electronic properties of the space charge layer of the L-CVD SnO_2 ultra thin films*

In this work we present the results of systematic X-ray Photoelectron Spectroscopy (XPS) and Photoemission Yield Spectroscopy (PYS) studies of the electronic properties of space charge layer of L-CVD SnO_2 ultrathin films submitted to various technological treatments. The interface Fermi level position in the band gap EF – Ev has been determined from XPS analysis of the Sn3d5/2 binding energy position. Such a value of the Fermi level position is in good agreement with the value estimated from the offset of XPS valence band. The variation of interface Fermi level position, after the various

technological treatments, has been compared to the change of work function obtained by PYS. Valence band XPS spectra and PYS spectra point to the presence of two different types of filled electronic band gap states of the L-CVD SnO_2 thin films. The energies of these two states are at 6.0 eV and 3.0 eV below the Fermi level. The changes of electronic properties of the space charge layer of L-CVD SnO_2 ultrathin films submitted to different technological procedures are assigned to the observed variation of their surface chemistry, including stoichiometry/nonstoichiometry and to the presence of surface carbon contamination.

P. Kowalik (PhD), *Optimisation of technology of preparation of amorphous binary and hybrid resistive layers for application in electronics*

Over the last couple of years investigation studies have been carried out on a new technology, which would allow obtaining fixed film resistors of wide resistance range, with parameters reflecting the quality of precise film resistors. For the realization of such an objective, the technology of chemical metallization can be applied due to its low cost, simplicity and no requirements to apply complicated apparatus. It follows from the introductory tests, confirmed by the collected literature data, that it is impossible to base the production technology of resistive films within full resistance range on one type of resistive alloy This is due to the fact that it is not possible to obtain temperature resistance coefficient at the level 25 ppm/K in the full resistance range. We can conclude from the above that it is necessary to apply a few types of resistive alloys with each of them being applied in a precisely defined resistance range. Making use of respective criteria, involving the electrical properties of precise resistors specified in standard specifications, the following types of resistive alloys were selected for the four suggested resistance ranges:

1. For resistors having the surface resistance below 0.5 Ω/ we propose to apply films Ni-Cu -P.
2. For resistors having the sheet resistance from 0.5 to 10.0 Ω/ we propose to apply resistive alloys Ni-P.
3. For resistors having the surface resistance within the range 10÷100 Ω/ it is necessary to introduce an additional metal to the alloy, and therefore the application of the film type Ni-W-P is suggested.

The multicomponent amorphous resistive films obtained in this way allow to obtain precise film resistors within the sheet resistance 0.2÷1000 Ω/ characterized by long-term stability of the order 0.1÷0.5% of the changes of initial resistance, and TCR below 25ppm/K. The tests carried out during the elaboration of this technology allow us to formulate a few final conclusions:

- The most important parameter affecting the electrical properties of the final product is the temperature of phase transition amorphite-crystallite of the multi-component resistive alloy. This temperature depends principally on the concentration of phosphorus in the solid solution metal-phosphorus, since oversaturation of this solution with phosphorus accelerates the crystallization process of the system, which limits the applicability of the two-component alloy Ni-P only to a narrow range of surface resistance of the order 0.5÷10.0 Ω/ .

- The stability increase of the two-component alloy Ni-P can be obtained by the introduction of a high-melting transition metal such as tungsten or rhenium, by which we can extend the range of obtained initial sheet resistances to the value of about 100 Ω/ . As opposed to high-melting metals, the introduction of copper to the alloy Ni-P accelerates its crystallization, which sharply increases TCR of the alloy Ni-Cu-P. In order to prevent this process, tin is introduced to the system Ni-Cu-P, which renders the system amorphous again, by which it is possible to lower the bottom limit of sheet resistance of the final product to the level of 0.2 Ω/ .

W. Izydorczyk (PhD), J. Uljanow (PhD), *Electrical characterization of 1D SnO_2 nanowires*

Recently, researchers are considerably focused on nanostructured materials because of their unique optical, electronic, magnetic, and catalytic properties. By reducing the grain size of known materials, better physicochemical and mechanical properties can be obtained.
Many researchers believe that by using impedance spectroscopy it is possible to separate time constants corresponding to the different processes taking place in the NW. This is a very promising method because of huge problems with separation of individual NWs and making ohmic contacts. However, in such conditions, one can only directly measure electrical characteristics of individual NWs. The use of impedance spectroscopy for the swarming NW can achieve almost identical information without all the technical difficulties pertaining to a single NW. Unfortunately, in most of the earlier studies, the authors had confined themselves to interpreting the results of measurements in terms of parallel connection of resistance and the element of constant phase shift. The latter usually is very similar to the capacity, prompting the researchers to adopt the NW model in the form of a parallel RC circuit. This way, one looses the possibility of time constants separation for the simplicity of the model.
The present study has proposed a method to estimate the impedance of a sample composed of SnO_2 NWs. The basis of the procedure is a rational function approximation method of amplitude-phase response of impedance function, known in the literature as vector fitting. A rational function approximation alone is insufficient in this case. A suitable model should be feasible to implement in the form of a linear passive circuit.
The studied sensor structures were based on one-dimensional SnO_2 NWs grown by thermal deposition on silicon substrate. The topography of SnO_2 NWs was investigated by means of scanning electron microscopy (SEM). The results of qualitative and quantitative analysis in a selected microregion have been presented. Furthermore, measurement of the samples' impedance in the frequency domain allowed building a circuit model describing the transport phenomena in NWs. The diameter of the NWs was found to be associated with the mechanisms of charge transport, but theoretical details of this relationship are not known yet. Developing models of transport phenomena could provide further information about the microscopic structure of the NW on the basis of electrical measurements, which will be the subject of future research. On the other hand, the development and modification of technological

processes used will enable the optimization of 1D SnO_2 nanostructures produced, which may find application in electronics, sensors, and photovoltaics.
This research was carried out in cooperation with Dr. J. Izydorczyk, Dr. M. Magnuski and Dr. J. Mazurkiewicz.