



INSTITUTE
OF MICROELECTRONICS
AND OPTOELECTRONICS



ANNUAL REPORT
1999

Edited by Agnieszka Mossakowska-Wyszyńska

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From the Director

The Institute of Microelectronics and Optoelectronics was founded in 1970. It evolved out of the Chair of Radio Engineering created by Professor Janusz Groszkowski in 1929. This Annual Report summarises the research activities of the Institute in 1999, as well as the teaching activities in the academic year 1998/1999.

We will remember 1999 as the year of the death (April, 15-th) of Professor Alfred Świt - the main creator and Head of the Institute for many years. In spite of a grave illness he managed the Institute till the last moments of his life. In chapter 2 of this Report we present Professor's activities in more detail. Here,

I would like to share with the Reader my personal memories of this great man.

During almost 30 years Professor Alfred Świt had been forming our Institute by instructing successive generations of the staff. He constantly inspired and invited us to creatively participate in this work. An extremely demanding teacher, simultaneously he was an indulgent tutor. A man of distinguished personality and authority, he exerted considerable influence on his co-workers, but at the same time

he prized independent thoughts and initiatives. Due to his wisdom and bold imagination the Institute safely passed through the years of transformations caused by external situation, mainly by economical conditions in the nineties. Professor Świt consolidated and mobilised us to overcome difficulties and to gain the planned goals. He knew how to encourage us to care for high standards in all academic activities.

Unmistakable sense of the real priorities in research and education trends, as well as simultaneous support for initiative and independent thinking, brought good results. Professor Świt left the Institute in good condition and with prospects for development. The main activity of the Institute is focused now on system implementations in both microelectronics and optoelectronics. These two areas include VLSI systems, microelectronic and nanoelectronic semiconductor devices, hybrid circuits (e.g. microwave, optoelectronic), sensors, laser optoelectronics, electronic imaging and image processing.

The activities and successes of the Institute's staff in the development of the domain mentioned above may be easily assessed considering valuable publications (presented further in this Report) and constant improvement of the research and teaching infrastructure, as well as the significant value of the research projects carried out in the Institute, among them of many grants within international programmes.

We gratefully remember Professor Alfred Świt and we do our best to multiply these attainments which determine the position of our Institute in the Faculty of Electronics and Information Technology. As the current director I see my basic task to be of use to in the continuation of the creative and harmonious development of the Institute. It is possible only with the effort and friendly co-operation of all the staff of the Institute. I express my sincere appreciation for this contribution.

Warsaw, January 2000

Andrzej Pfitzner, Ph.D.,D.Sc.

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1. GENERAL INFORMATION

1.1. Organisation of the Institute and Areas of its Activities

The Institute of Microelectronics and Optoelectronics is a part of the Faculty of Electronics and Information Technology - the largest Faculty of the Warsaw University of Technology.

Our Institute consists of five divisions:

- Microelectronics Division;
- Microwave Devices Division;
- Electronic Materials and Processing Division;
- Optoelectronics Division;
- Image Processing Division;

Vacuum Science and Technology Group, which exists beyond the division structure, is characterised in more details in the further part of the report.

The main activity of the Institute is focused now on system implementations in both microelectronics and optoelectronics. During the past thirty years the Institute has built up its competence in:

- modelling of physical effects in modern semiconductor devices;
- monocrystalline and amorphous silicon processing and its modelling,
- non-standard dielectric layer deposition techniques;
- developing the methods and measuring systems for electronic materials and electronic devices studies;
- generation of microwaves, microwave measurement techniques, and numerical methods for electromagnetics;
- processing, designing, optimisation techniques and development of VLSI (very large scale integration of circuits) computer-aided tools;
- developing the hybrid circuits technology with special emphasis on thick-film technology and its applications to hybrid microwave integrated circuits;
- laser physics (Fabry-Perot and distributed feedback lasers), laser spectroscopy of solid state active materials, and applications of lasers in medicine, manufacturing and

telecommunications;

- the construction and characterisation of optoelectronics elements and devices including fiber sensors;
- computer-aided design of photoelectronic image devices, image processing and visualisation of results of experiments with image devices;
- vacuum science and technology - computer-aided design of vacuum systems, modelling of the gas flow in vacuum systems, studies of gas parameter distribution in calibration chambers (vacuum metrology).

The research activities are supported by the grants from State Committee for Scientific Research and also by the European projects like Inco Copernicus, Vilab Copernicus, ICOP-DEMO, Maria Curie Skłodowska, and NATO for peace.

The results of our scientific activities were published in many paper submitted to prestigious international scientific journals and presented on national and mostly on international conferences in the form of communications as well as the invited lectures. Our involvement in these projects together with a growing number of personal contacts with foreign scientists lead us to formal agreements on international scientific co-operation (over 20) and participation in a number of international scientific joint projects (about 10).

In 1999 the Institute employed 9 professors, 4 associate professors, 36 assistant professors and senior lecturers and 9 assistants.

Following the modification of teaching program on the Faculty our activities in education are divided into three separate courses: B.Sc. level, M.Sc. level and postgraduate studies (33 students). In 1999 23 students received the degrees of B.Sc. and 20 students received the degrees of M. Sc., mainly in optoelectronics, microelectronics and computer engineering. Moreover, we provided several postgraduate courses on the design of VLSI circuit under the common name of ADEC.

1.2. Board of Directors

Director of the Institute

Alfred Świt, Ph.D., D.Sc. Full Professor

Director of the Institute

Andrzej Pfitzner, Ph.D., D.Sc. Senior Lecturer
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Deputy-Director for Research Affairs

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Deputy-Director for Teaching Affairs

Elnbieta Piwowska, Ph.D., Assistant Professor,
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Deputy-Director for Technical and Administrative Affairs

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1.3. Microelectronics Division

Head of the Division

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Senior academic staff

Bogdan Majkusiak, Ph.D., D.Sc.,	Professor
Wiesław Kuźmicz, Ph.D., D.Sc.,	Professor
Jan Szmidt, Ph.D., D.Sc.,	Professor
Romuald B. Beck, Ph.D., D.Sc.,	Associate Professor
Tomasz Brożek, Ph.D.,	Assistant Professor
Tomasz Janik, Ph.D.,	Assistant Professor
Zbigniew Jaworski, Ph.D.,	Assistant Professor
Małgorzata Jurczak, Ph.D.,	Assistant Professor
Lidia Łukasiak, Ph.D.,	Assistant Professor
Mariusz Niewczas, Ph.D.,	Assistant Professor
Zbigniew Pióro, Ph.D.,	Assistant Professor
Elżbieta Piwowarska, Ph.D.,	Assistant Professor
Witold Pleskacz, Ph.D.,	Assistant Professor
Andrzej Rosiński, Ph.D.,	Assistant Professor
Jerzy Rużyło, Ph.D., D.Sc.,	Associate Professor
Aleksander Werbowy, Ph.D.,	Assistant Professor
Adam Wojtasik, Ph.D.,	Assistant Professor
Andrzej Pfizner, Ph.D., D.Sc.,	Senior Lecturer
Antoni Siennicki, Ph.D.,	Senior Lecturer
Jan Gibki, Ph.D.,	Lecturer
Józef Maciak, M.Sc.	Lecturer

Junior academic staff

Mirosław Grygolec, M.Sc.,	Assistant
Robert Miklas, M.Sc.,	Assistant
Andrzej Wielgus, M.Sc.,	Assistant
Agnieszka Zarzba, M.Sc.,	Assistant
Piotr Brzozowski, M.Sc.,	Ph.D. Student
Tomasz Dźbki, M.Sc.,	Ph.D. Student
Krzysztof Domański, M.Sc.,	Ph.D. Student
Grzegorz Janczyk, M.Sc.,	Ph.D. Student
Adam Jarosz, M.Sc.,	Ph.D. Student
Kamil Kosiel, M.Sc.,	Ph.D. Student
Marek Kostana, M.Sc.,	Ph.D. Student
Jacek Laskowski, M.Sc.,	Ph.D. Student
Adam Lejman, M.Sc.,	Ph.D. Student
Marcin Malicki, M.Sc.,	Ph.D. Student
Emilian Półrońnik, M.Sc.,	Ph.D. Student
Sławomir Szostak, M.Sc.,	Ph.D. Student
Maung Than Htun Aung, M.Sc.,	Ph.D. Student
Jakub Walczak, M.Sc.,	Ph.D. Student
Andrzej Wojtkiewicz, M.Sc.,	Ph.D. Student

Technical and administrative staff

Witold Ciemiewski
Kazimierz Dalbiak
Jerzy Gempel, M.Sc.
Stanisław Jeszka, M.Sc.
Krzysztof Krogulski
Marcin Sadowski, M.Sc.
Małgorzata Trzaskowska
Andrzej Wałkanis, M.Sc.

1.4. Microwave Devices Division**Head of the Division**

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The Microelectronics Division consists of two research and teaching groups:

- Technology Diagnostics and Modelling Group;
- CAD Research Group.

The research carried out in the former group falls into three main areas: technology, diagnostics and modelling of MOS (metal-oxide-semiconductor) structures, as well as application of microelectronics in digital signal processing.

To name a few examples of its research topics:

- modelling and investigation on kinetics of silicon oxidation;
- wear-out and degradation processes in MOS structures (breakdown of dielectric layers, hot carries effects, radiation damage effects);
- transport mechanisms and quantum effects in MOS structures (transistor, tunnel diode) with ultrathin oxides;
- new materials for microelectronics applications (e.g. diamond-like carbon, borazone);
- theoretical studies on MOS-SOI (silicon on insulator) structures physics.

Current research projects in the latter research group of the Division are as follows:

- methodologies of integrated circuit design for manufacturability: application of statistical process and device simulation in IC design, investigations of spatial on-chip correlations of random process disturbances, analysis of layout sensitivity to spot defects;
- methods of formal and functional verification of IC design: methods of verification of logical circuits, methods of determination of circuit topography sensitivity on point defects;
- novel mathematical methods of technological processing modelling in application to statistical simulation;
- novel two-dimensional mathematical simulation of semiconductor devices;
- design of analogue VLSI circuits: analogue implementations of fuzzy logic controllers with biomedical applications, methodologies of testing and design for testability of analogue VLSI integrated circuits;
- development of CAD tools for integrated circuit design and verification, with special emphasis on analogue full custom ASICs design;
- investigations of signal propagation and crosstalk in long interconnections in submicron VLSI circuits;
- design of digital and mixed VLSI circuits for special applications: speech synthesis, data processing in physical experiments, etc.

Senior academic staff

Sławomir Palczewski, Ph.D.,	Assistant Professor
Jerzy Piotrowski, Ph.D.,	Assistant Professor
Bernard Jakubowski, Ph.D.,	Senior Lecturer
Jerzy Skulski, M.Sc.,	Senior Lecturer

Junior academic staff

Jarosław Dawidczyk, M.Sc.,	Ph.D. Student
Zbigniew Pieńkowski, M.Sc.,	Ph.D. Student
Zenon Szczepaniak, M.Sc.,	Ph.D. Student

Technical and administrative staff

Barbara Szymulska

The research activity of the Microwave Devices Division is concerned with propagative electronics. The characteristic feature of the electronics branch is the comparability between the time of

system state change and the time of signal propagation between particular system points.

The research activity of the Microwave Devices Division is concentrated on:

- an analysis of the oscillation conditions, frequency stabilisation and synthesis in microwave bands;
- measurement techniques of microwave circuits and devices parameters with emphasis on automation and computerisation of measurement methods;
- analysis methods of transmission lines for modern mm-wave microwave integrated circuits.

From the new topics of research activity we can mention:

- modelling and computer aided design of microwave transmission lines and devices;
- microwave sensors for industrial applications;
- controlling of microwave circuits parameters by means of optical signals
- optoelectronics and microwave devices for data transmission networks.

1.5. Electronic Materials and Processing Division**Head of the Division**

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Senior academic staff

Jerzy Krupka, Ph.D., D.Sc.,	Professor,
Mikołaj Baszun, Ph.D.,	Assistant Professor
Michał Borecki, Ph.D.,	Assistant Professor
Jerzy Kalenik, Ph.D.,	Assistant Professor
Ryszard Kisiel, Ph.D.,	Assistant Professor
Krystyna Lachowska, Ph.D.,	Assistant Professor
Stanisław Pietruszko, Ph.D.,	Assistant Professor
Lullita Pogorzelska, Ph.D.,	Assistant Professor
Maria Bełłowska, Ph.D.,	Senior Lecturer
Zdzisław MŚceński, Ph.D.,	Senior Lecturer
Janusz Rogowski, Ph.D.,	Senior Lecturer
Zbigniew Szczepański, Ph.D.,	Senior Lecturer

Junior academic staff

Dariusz GrzŚda, M.Sc.,	Ph.D. Student
Agata Jasik, M.Sc.,	Ph.D. Student
Marek Kostana, M.Sc.,	Ph.D. Student
Leszek KsiŚ Śk, M.Sc.,	Ph.D. Student

Technical and administrative staff

Ryszard Biaduń
Marek Gutkowski, M.Sc.
Zbigniew Rudkowski
Krystyna Szyłko

The research activity of the Division concentrates on electronic materials and processing. Fundamental and applied research are carried out. Research groups are organised for defined tasks.

The main research areas are as follows:

- fabrication and investigation of the following optoelectronic devices: integrated passive and active lightwave guiding structures (modulators, bistable switches etc.) and fibre optic sensors;
- computer engineering for fibre optics;
- new techniques of surface mounted devices on PCB (printed circuit boards);
- application of thin and thick film technology in gas sensors and pressure sensors;
- investigation of the electronic structure, stability and optical properties of amorphous silicon and its devices (thin film transistors, solar cells, etc.).
- research, design and monitoring of photovoltaic systems, strategy for development of photovoltaic solar energy.

1.6. Optoelectronics Division**Head of the Division**

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Senior academic staff

Michał Malinowski, Ph.D., D.Sc., Professor
Paweł Szczepański, Ph.D., D.Sc., Associate Professor
Tadeusz Adamowicz, Ph.D., Assistant Professor
Jerzy KŚsik, Ph.D., Assistant Professor

Agnieszka Mossakowska-Wyszyńska, Ph.D., Assistant Professor
 Anna Tyszką-Zawadzka, Ph.D., Assistant Professor
 Piotr Warda, M.Sc., Assistant Professor

Junior academic staff

Krzysztof DziŚciołowski, M.Sc., Ph.D. Student
 Marcin Kaczkan, M.Sc., Ph.D. Student
 Tomasz Kossek, M.Sc., Ph.D. Student
 Wojciech KwaŚniewski, M.Sc., Ph.D. Student
 Ryszard Piramidowicz, M.Sc., Ph.D. Student
 Piotr Witoński, M.Sc., Ph.D. Student
 Artur Wnuk, M.Sc., Ph.D. Student

Technical and administrative staff

Stanisław Jonak, M.Sc.
 Marek Markiewicz

The activity of the Optoelectronics Division is concentrated on education as well as on various areas of optoelectronic research in the field of laser physics, laser spectroscopy, laser construction and laser applications in medicine and air pollution monitoring.

The academic staff of the Division give lectures in photonics, laser physics, laser technology, laser applications, laser

spectroscopy, integrated optoelectronics and optical computing, all of which are accompanied by appropriate laboratory class activities

The main research activity of the Division comprises:

- solid state laser construction and investigation of their applications in materials processing;
- spectroscopic research of new laser materials, investigation of the excitation processes in rare earth doped dielectric materials, research of blue up-conversion laser structures;
- theoretical research of laser generation in planar, fibre and hollow waveguide gas lasers, analysis of light generation in DFB (distributed feedback) structures and in lasers with non-linear optical elements, investigation of the statistical properties of the light generated in various laser structures;
- research of light generation in metal vapour gas lasers, measurement of laser parameters, investigation of light generation in hollow cathode lasers, analysis of plasma discharge processes, research of the optogalvanic effect;
- optimisation of the construction of ion gas lasers, investigation of the processes in discharge tube ceramic ion laser and laser operation in various cavity geometry, investigation of light generation in ion gas lasers for medical applications.

1.7. Image Processing Division

Head of the Division

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Senior academic staff

Hanna Górkiewicz-Galwas, Ph.D., Senior Lecturer

Junior academic staff

Bartosz Dudziński, M.Sc., Assistant
 Grzegorz Kukiełka, M.Sc., Assistant
 Ryszard PajŚk, M.Sc., Assistant
 Przemysław Baszak, Ph.D. Student
 Tomasz Grudniewski, Ph.D. Student

Technical and administrative staff

Barbara Bałan, Ph. D. Med.
 Jerzy Domański, M.Sc.

The main areas of activity of the Division are education and research, both in the field of the technology of electronic imaging and of digital image processing. Members of the academic staff are involved in research and development works on:

- theoretical principles of image modelling;
 - numerical methods of image analysis;
 - implementation of digital image processing for detection, inspection and identification of objects;
- application of image processing methods for diagnostic control and measurement systems in industry, medicine, research and commerce.

1.8. Vacuum Science and Technology Group

Senior academic staff

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Junior academic staff

Marek Niewiński, M.Sc., Assistant
 Karol Szymański, M.Sc., Ph.D. Student

Technical and administrative staff

Piotr Karwański

The research work of the Vacuum Technology Team is concentrated on the three main fields:

- vacuum metrology (adaptation of Polish rules to European standards),
- gas flow simulation in vacuum systems,
- development of CAD of vacuum systems.

These works are focused on modelling of low pressure standards.

1.9. Statistical data

SPECIFICATION	1998	1999	DIFFERENCE
Academic staff	87	85	-2
Full professors	5	3	-2
Professors	4	6	+2
Associate professors	4	3	-1
Assistant professors	25	27	+2
Senior lecturers	8	11	+3
Lecturers	3	1	-2
Assistants and Ph.D. students	38	34	-4
Technical staff	18	17	-1
Administrative staff	5	5	0
Space	3135.3	3213,2	+77,9
Teaching laboratories	1318.7	1275,9	-42,8
Other laboratories	269.3	341,3	+72
Offices of academic staff	1547.3	1596	+48,7
Computers	148	226	+78
Library resources	9265	9534	+269
Books (number of volumes)	9260	9534	+274
Journals (number of titles subscribed to)	5	0	-5
Teaching activities	65	58	-7
Basic courses	54	47	-7
Advanced courses	7	8	+1
Special courses	2	2	0
International projects	2	1	-1
Research projects	67	73	+6
Granted by the University	26	32	+6
Granted by State Institutions	20	26	+6
Granted by International Institutions	21	5	-16
Other projects	0	10	+10
Degrees awarded	37	48	+11
D.Sc. degrees	0	1	+1
Ph.D. degrees	2	3	+1
M.Sc. degrees	30	25	-5
B.Sc. degrees	5	19	+14
Publications	166	158	-8
Sci.-tech. books	2	6	+4
Sci.-tech. papers in journals	30	73	+43
Sci.-tech. papers in conference proceedings	89	77	-12
Teaching aids	9	0	-9
Other publications	36	2	-34
Reports	23	49	+26
Research reports	23	30	+7
Other reports	0	19	+19
Patents	2	1	-1
Conferences	111	172	61
Organised by the Institute (number of conferences)	2	1	-1
Organised by the Institute (number of participants)	12	75	+63
Others (number of conferences)	34	36	+2
Others (number of participants from the Institute)	63	60	-3

2. STAFF

2.1. Senior Academic Staff

Alfred Henryk ŚWIT 1928 – 1999

Professor, Member of the Polish Academy of Sciences, Ph.D., D.Sc., Semiconductor Electronics, Microelectronics

Prof. A. Świt was born 1.12.1928 in Poznań. During the II-nd World War: 3 months in concentration camp in 1941, then slave – labour in German motor-shops until 1945. Secondary school certificate - 1948. Studies: 1-st year - Faculty of Electrical Engineering at Łódź University of Technology, then at Warsaw University of Technology: engineer degree in radioelectronics (communication) - 1952, Master of Science - 1956.

Employee in radio industry for one year. Since 1952 employed in Warsaw University of Technology (initially as an assistant in Department of Radioelectronics). Doctors dissertation: “Semiconductor Converter from Infrared to Visible Radiation” (Prof. conf. - J. Groszkowski) – Ph.D.: 25.06.1963. Assistant professor dissertation: “Measurements of Diffusion Length of Minority Carriers in Thin Semiconductor Wafers” – D.Sc.: 11.01.1966. Associate professor - 12.05.1970, tenured (full) professor - 5.02.1976.

Scientific activity: semiconductor electronics and microelectronics, dozens of publications in the following research fields: semiconductor photoelectric devices (infrared detector PbTe, image converter for night vision devices, model of black body), transport phenomena of carriers in semiconductor wafers (original methods of measuring diffusion length and lifetime of excess charge carriers), p-n junction (junction capacitance and method of its measurement), bipolar transistors (second breakdown, design methods), conduction mechanism in silicon covered by ultra-thin oxide layer. A lot of works resulted in practical research methods or measuring instruments.

Teaching activity: semiconductor electronics – first lectures since 1956 (Faculty of Communication, later of Electronics); creator and manager of laboratory of semiconductor devices. Author of the handbook “Semiconductor devices” (1968) and co-author of its subsequent editions. Tutor of over 100 Master’s theses, professor conferring 11 doctors degrees.

Highly rich organisational activity:

- In Warsaw University of Technology: Head of the Semiconductor Devices Division (in the Department of Electron Devices) 1966-1968, Head of the Department of Solid State Electronics 1968-1970, Head of the Microelectronics Division 1978-1984, Director of the Institute of Electron Technology (actually Microelectronics and Optoelectronics) 1970-1978 and 1984-1999; Deputy Dean 1966-1969 and Dean 1969-1970 of the Faculty of Electronics, Vice-Rector for General Affairs 1970-1973, Vice-Rector for Research Affairs 1978-1981 and Acting Rector (29.01.1981-23.04.1981).
- In Polish Academy of Sciences: Member of the Academy: Associate - 1976, Full - 1989; in Electronics and Telecommunication Committee: Member since 1969, Vice-President 1972-1974, President 1974-1981 and since 1996; President of the Programme Committee of the Electronics and Telecommunication Quarterly; Secretary of the IV-th Department of Technical Sciences 1987– 1990. Member of the Cosmic Research Committee (since 1978), Member of the Scientific Councils of Institutes: of Biocybernetics and Biomedical Engineering and of Basics of the Informatics.
- In other institutions: Member of the Normalisation and Measure Committee (1972 - two terms), Member of the Central Qualifying Commission for Scientific Staff Affairs (1973 - few terms), Member of the State Awards Committee (1975 - 1987) Member of the Science and Technical Progress Committee (1985 - one term), Member of many councils: Scientific Council for RTV Affairs - President, Scientific and Technical Council attached to the Ministry of Industry – Vice-President and President, Scientific Council of the Institute of Electron Technology - President. Vice-President of the Principal Board of the Polish Electrician Association (1972-1975) and Member of the Programme Committee of the Journal “Elektronika”. Senior Member of the IEEE (1972).
- Winner of many honours for research, teaching and/or organisation activity: Award of the IV-th Department of the Polish Academy of Sciences - 1965, 9 Awards of the Ministry of the Science, High Education and Technology, tens Awards of the Rector of Warsaw University of Technology, Chivalrous (1973) and Commander’s (1980) Crosses of the Polish Revival Order, Medals of Merit for Country Defences, Medal of the National Education Committee (1977) Medal “of Merit for Warsaw”, “Gold Honour Medals” of Principal Technical Organisation and of Polish Electrical Association.

Profesor Alfred Świt died in Warsaw on April the 15-th, 1999.

Tadeusz Adamowicz, M.Sc. ('62), Ph.D. ('73), Quantum Electronics, Gas Discharges;
Assistant Professor, full time, Optoelectronics Division

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Mikołaj Baszun, M.Sc. ('69), Ph.D.('77), Electronic Sensors, Assistant Professor, full time,
Electronic Materials and Processing Division

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Maria Beblowska, M.Sc. ('63), Ph.D. ('78), Optoelectronic Devices, Senior Lecturer, part
time, Electronic Materials and Processing Division, SEP ('80)

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Romuald B. Beck, M.Sc. ('76), Ph.D. ('82), D.Sc. ('96), Microelectronics, Electronics,
Associate Professor, full time, Microelectronics Division, Leader of the Technology,
Diagnostics and Modelling Group ('85-), Member of the Microelectronics Section of the
Electronics and Telecommunication Committee of the Polish Academy of Sciences
(‘93-), Member of IEEE ('97-), Member of Electrochemical Society ('98-)

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3. TEACHING ACTIVITIES

3.1. Basic Courses

- [Edu1] **Application of Matlab in Calculation Methods** (Matlab w zastosowanych metodach obliczeniowych) **MZMO**, Mikołaj Baszun
- [Edu2] **Basics of Vacuum Technics** (Podstawy techniki próżni), **PTP**, Piotr Szwemin
- [Edu3] **Basics of Optics** (Podstawy Optyki), **POPT**, Kazimierz Gniadek
- [Edu4] **CAD for PCB (PADS)** (Wspomaganie komputerowe projektowania obwodów drukowanych), **PADS**, Ryszard Kisiel, Jerzy Kalenik
- [Edu5] **Characterisation of Microelectronic Structures and Technologies** (Charakteryzacja struktur i technologii mikroelektronicznych), **CSTM**, Bogdan Majkusiak
- [Edu6] **Characterisation of Solid State** (Metody badania ciała stałego), **BCS**, Piotr Szwemin
- [Edu7] **Computer Aided Design and Manufacturing of Microwave Circuits** (Komputerowe projektowanie i realizacja obwodów mikrofalowych), **KPROM**, Sławomir Palczewski
- [Edu8] **Electronics 1** (Elektronika 1), **ELKA1**, Andrzej Jakubowski, Andrzej Pfitzner
- [Edu9] **Electronics 3** (Elektronika 3), **ELKA3**, Wiesław Kuźmich
- [Edu10] **Fundamentals of Microprocessor Techniques** (Podstawy techniki mikroprocesorowej), **TMIK**, Lidia Łukasiak
- [Edu11] **Fundamentals of Solid State Electronics** (Elektronika ciała stałego), **ELCS**, Jan Szmidt, Witold Pleskacz
- [Edu12] **Fundamentals of Solid State Electronics 2**, (Elektronika Ciała Stałego 2), **ELCS2**, Zdzisław Mźczęński, Janusz Rogowski
- [Edu13] **Hardware Implementation of Algorithms in VLSI Circuits** (Sprzętowa implementacja algorytmów w układach VLSI), **SAV**, Krystyna Siekierska (Institute of Electron Technology), Elżbieta Piwowarska
- [Edu14] **High Frequency Techniques** (Podstawy techniki w.cz.), **TWCZ**, Bogdan Galwas
- [Edu15] **Hybrid Integrated Circuits Technology** (Technologia hybrydowych układów scalonych), **THUS**, Zbigniew Szczepański
- [Edu16] **Integrated Optoelectronics** (Optoelektronika zintegrowana), **OZT**, Michał Malinowski
- [Edu17] **Introduction to the UNIX System** (Użytkowanie systemu UNIX), **USUX**, Andrzej Wielgus
- [Edu18] **Laser Applications** (Zastosowania laserów), **ZLA**, Jerzy Kzśik
- [Edu19] **Laser Engineering** (Technika laserów), **TL**, Faculty of Applied Physics and Mathematics WUT, Tadeusz Adamowicz
- [Edu20] **Laser Physics** (Fizyka laserów), **FLA**, Paweł Szczepański
- [Edu21] **Laser Physics 2** (Fizyka laserów 2), **FL2**, Paweł Szczepański
- [Edu22] **Logic Circuits** (Układy logiczne), **UKLO**, Institute of Control and Computation Engineering WUT, Adam Wojtasik
- [Edu23] **Materials, Elements and Design of Electronic Equipment** (Materiały, elementy i konstrukcje), **MEiK**, Ryszard Kisiel
- [Edu24] **Materials, Elements and Design of Electronic Equipment 2** (Materiały, elementy i konstrukcje2), **MEiK2**, Ryszard Kisiel
- [Edu25] **Methods and Algorithms for Design Automation of VLSI circuits** (Metody i algorytmy automatyzacji projektowania struktur scalonych), **MAPS**, Adam Wojtasik
- [Edu26] **Microelectronics Development Trends** (Kierunki rozwoju mikroelektroniki), **KRM**, Andrzej Jakubowski
- [Edu27] **Microwave and Optowave Integrated Circuits** (Mikrofalowe i optofalowe układy scalone), **MOUS**, Jerzy Piotrowski
- [Edu28] **Models and Systems of Image Processing** (Modele i systemy przetwarzania obrazów), **MSPO**, Jerzy Woźnicki
- [Edu29] **Noise Reduction in Electronics Systems** (Minimalizacja zakłóceń w aparaturze i systemach elektronicznych), **MZA**, Zdzisław Mźczęński
- [Edu30] **Numerical Methods** (Metody numeryczne), **MNM**, Institute of Electronic Fundamentals WUT, Jerzy Krupka
- [Edu31] **Object Programming in Java** (Praktyka programowania obiektowego w Javie), **PPOJ.**, Adam Wojtasik
- [Edu32] **Operating Systems 1** (Systemy operacyjne 1), **SOP1**, Andrzej Wielgus
- [Edu33] **Optowave Telecommunication** (Telekomunikacja optofalowa), **TEOP**, Bogdan Galwas
- [Edu34] **Photoelectric Phenomena in Semiconductors** (Zjawiska fotoelektryczne w półprzewodnikach), **ZFPP**, Stanisław Pietruszko
- [Edu35] **Photonics' Fundamentals** (Podstawy fotoniki), **FOT**, Michał Malinowski, Wiesław Woliński
- [Edu36] **Physical Fundamentals of Information Processing** (Fizyczne podstawy przetwarzania informacji), **FPPI**, Bogdan Majkusiak
- [Edu37] **Physics of Solid State** (Fizyka ciała stałego), **FCSR**, Jan Szmidt
- [Edu38] **Programming** (Programowanie), **PROG**, Adam Wojtasik, Marek Niewiński
- [Edu39] **Quality and Productivity Management** (Zarządzanie produktywnością i jakością), **ZPJ**, Julita Pogorzelska
- [Edu40] **Quality in Design and Manufacturing** (Jakość w procesach projektowania i wytwarzania), **JPPW**, Zdzisław Mźczęński
- [Edu41] **Semiconductor Devices** (Przyrządy półprzewodnikowe), **PPR**, Andrzej Jakubowski
- [Edu42] **Semiconductor Devices for Optoelectronics** (Półprzewodnikowe elementy optoelektroniczne), **POE**, Paweł Szczepański
- [Edu43] **Silicon Thin Films** (Cienkie warstwy krzemowe), **CWK**, Stanisław Pietruszko
- [Edu44] **Surface Mounting Technology** (Technologia montażu powierzchniowego), **TMP**, Ryszard Kisiel
- [Edu45] **Technology of Integrated Circuits Fabrication** (Technologia monolitycznych układów scalonych), **TWMUS**, Romuald Beck
- [Edu46] **Thin Film Material Engineering** (Cienkowarstwowa inżynieria materiałowa), **CIM**, Jerzy Kruszewski
- [Edu47] **VLSI Design in Stansard Cell Style** (Projektowanie układów scalonych VLSI w stylu komórek standardowych), **PUVS**, Zbigniew Jaworski

3.2. Advanced Courses

- [Edu48] **Advanced Microelectronic and Optoelektronic Technologies** (Zaawansowane technologie mikroelektroniczne i optoelektroniczne), **ZTMO**, Romuald Beck
- [Edu49] **Advanced Physical Fundamentals of Optoelectronics** (Zaawansowane podstawy fizyczne optoelektroniki), **ZPFO**, Paweł Szczepański
- [Edu50] **Design of VLSI Circuits** (Projektowanie struktur scalonych VLSI), **PSSV**, Wiesław Kuśmierz
- [Edu51] **Digital Image Processing** (Cyfrowe przetwarzanie obrazów), **CPOO**, Jerzy Wośnicki
- [Edu52] **Electronic and Photonic Devices for Telecommunication** (Przyrządy elektroniki i fotoniki dla telekomunikacji), **PEFT**, Bogdan Galwas
- [Edu53] **Integrated Optoelectronic Circuits and Optical Logic Circuits** (Zintegrowane układy optoelektroniczne i optyczne układy logiczne), **ZOUL**, Michał Malinowski
- [Edu54] **Physical Fundamentals of Nanoelectronics** (Podstawy fizyczne nanoelektroniki), **PFN**, Bogdan Majkusiak
- [Edu55] **Semiconductor Structures for VLSI and ULSI Circuits** (Struktury półprzewodnikowe dla układów VLSI i ULSI), **SPVU**, Andrzej Jakubowski

3.3. Courses in English

- [Edu56] **Electronics 1**, Bogdan Majkusiak
- [Edu57] **Physics 3**, Bogdan Majkusiak

3.4. International Co-operation in Education

- [Edu58] **Education of Microtechnology (EMIT)** TEMPUS-PHARE S_JEP-11298/96. Contractor: Jan Szmidt, September 1996 – August 1999

Partners:

1. Technical University of Łódź, Institute of Electronics (PL) - Coordinator
2. Technical University of Łódź, Institute of Materials Science & Engineering (PL)
3. Warsaw University of Technology, Institute of Microelectronics & Optoelectronics (PL)
4. Warsaw University of Technology, Faculty of Materials Science & Engineering (PL)
5. Technische Universität Berlin, Institut für Mikroelektronik & Festkörperelektronik (D)
6. Technische Universität Brunschweig, Institute für Elektrophysik (D)
7. State University of Gent, Department of Electronics (B)
8. Ecole Catholique d'Arts et Metiers, Service Materiaux Lab. (F)
9. European Commission Joint Research Centre, Institute for Advanced Materials (I)

The general objective of the project is related to the introduction of new degree courses and restructuring of existing degree courses leading to the development of the teaching ability in the area of microtechnology in the Polish universities involved in the proposed project. During our contacts with industry we were often informed that the knowledge of new graduated engineers in the area of microtechnology is not satisfactory in view of the needs of modern industry.

The technological laboratory, adequate for students training, is the lab of any microtechnology teaching. We established, therefore, the preparation of such a technological base of our teaching activity as the very important objective of the project. In Warsaw University of Technology, there exist already some labs with relevant technological equipment at the Institute of Micro- & Optoelectronics and the Faculty of Materials Engineering and they can be used as that base after small investment. In Technical University of Lodz, such a base must be just created. It will be founded at the Institute of Electronics as the Microtechnology Education Centre (MEC) which will serve all faculties of the University as the base for all the courses in the area of microtechnology.

4. RESEARCH PROJECTS

4.1. Projects Granted by the University

- [Pro+1] **The Development of Processing and Testing Methods of the Electronic Devices and Materials for Microelectronics and Optoelectronics** (Rozwój metod wytwarzania i badania materiałów i przyrządów w dziedzinie mikroelektroniki i optoelektroniki) Alfred Źwit - project leader, May 1998 - May 1999, **sub-projects:**
- [Pro1.1] **An Intelligent Sensor For Liquid Type Detection** (Inteligentny czujnik wyróżniający ośrodki ciekłe), sub-project leader: Jerzy Kruszewski, co-workers: Maria Bełłowska, Michał Borecki
The construction working principles of an intelligent sensor capable of distinguishing water, alcohol and oil has been elaborated. The sensor consists of intensity fiber head, lift and computer measurement device with a detection block. The detection block has an implemented neural network capable of distinguishing the detected medium. The detection is based on the processed data from measurement cycle. One cycle consists of head submerging, submersion, emerging and emergence in detected medium. In this way various physical phenomena are observed in measurement signal. The detector head is the ending of large core polymer optical fiber. The head works on the Fresnel reflection intensity basis.
- [Pro1.2] **Analysis, Realisation And Measurement Of Optical Link With Transmission Of Subcarrier** (Analiza, wykonanie i badanie łącza optycznego z modulacją na podnośnej), sub-project leader: Bogdan Galwas
The low loss, low cost, light weight, immunity to electromagnetic interference and extremely high bandwidth make optical fiber an excellent medium for transmission of microwave signals and data. The essence of optical link with transmission of subcarrier is to take all the modulating, demodulating, multiplexing and demultiplexing functions and perform them electrically. The only optical functions that remain are optical generation using a laser, optical transmission over an optical fiber and optical detection using a photodetector. The electrical components are cheaper and more reliable than optical ones, but optical transmission take the advantage of low fiber attenuation. The developed optical link was successfully used for transmission of data between different points of measurement systems.
- [Pro+1.3] **Application Of Defected Layers For Lateral Oxidation Of Silicon** (Wykorzystanie poziomu zdefektowanego do utleniania krzemu w kierunku horyzontalnym), sub-project leader: Romuald B.Beck, co-workers: Andrzej Jakubowski, Małgorzata Jurczak, Agnieszka Zarība, Kazimierz Dalbiak, Witold Ciemiewski, Małgorzata Trzaskowska
The experimental study of the feasibility of achieving SOI type substrates by lateral oxidation of silicon monocrystalline substrate. The study concentrates on etching windows to obtain access to damaged layers. The experiments proved that this cannot be achieved by wet etching, however dry etching methods could be the solution to the problem.
- [Pro1.4] **Design And Technology Of The Thick Film Piezoresistive Pressure Sensor** (Opracowanie konstrukcji i technologii piezorezystywnego ceramicznego czujnika ciśnienia), sub-project leader: Zbigniew Szczepański, co-workers: Ryszard Kisiel, Jerzy Kalenik, Ryszard Biaduń, Krystyna Szyłko
The piezoresistivity in thick film resistore is utilized in piezoresistive pressure sensor as well as sensors which allow the forces dedection.
For this purpose a new resistive paste with high gauge factor (GF) has been elaborated with cooperation of Institute of Electronic Materials Technology.
A simple GF measurement method has been designed. A few selected pastes were tested for comparison and their GF coefficients were evaluated. On the base of elaborated paste, a model of piezoresistive pressure sensor has been designed and tested. A newly developed paste was verified on ceramic membrane, giving a favourable sensor sensivity.~~For thick film pressure sensor application a new paste with high gauge factor (GF) has been elaborated and its piezoresistive properties were evaluated. For this purpose a simple GF measurement method has been designed. A few selected pastes for comparison were tested and the values of GF coefficient were evaluated. On the base of own paste, a model of piezoresistive thick film pressure has been designed and tested.~~
- [Pro1.5] **Extension Of Hardware And Software Possibilities Of The Image Processing Systems Laboratory** (Rozszerzenie bazy sprzętowej i programowej w laboratorium sytemów przetwarzania obrazów), sub-project leader: Hanna Górkiewicz-Galwas.
The aim of the project was to configure new experimental systems in Laboratory of Image processing Systems. They will be used for analysis of image sequences to detect moving objects and for the acquisition of images from the distant sources. Both systems have been supported by specially developed numerical programs.
- [Pro+1.6] **Fuzzy Logic Controllers Realisation On ARM Microprocessor** (Realizacja sterowników działających w oparciu o zasady logiki rozmytej z wykorzystaniem mikroprocesora ARM), sub-project leader: Zbigniew Jaworski, co-workers: Wiesław Kuźmicz, Andrzej Wałkanis, Andrzej Wielgus
The goal of this work was to determine applicability of microprocessors from the ARM family to rate-adaptive heart pacemakers. The fuzzy logic based control algorithm for pacemakers, developed earlier in another project, has been programmed in several versions, in order to determine the size of the code, the accuracy and the number of clock cycles necessary to complete a single run of the algorithm and the power consumption.
- [Pro1.7] **Measurement Of Electromagnetic Properties Of Ferrits And Ferroelectric Ceramic Versus Temperature** (Badania termiczne ferrytów oraz ceramiki ferroelektrycznej), sub-project leader: Jerzy Krupka, co-workers: Mikołaj Baszun, Janusz Rogowski, Zdzisław Mączeński, Leszek Książek, Dariusz Grzńda, Zbigniew Rudkowski
This work comprise research of thermal effects on the properties of ferrites and ferroelectric materials. For characterization of such effects temperature effects have been measured on complex permeability; complex permittivity, magnetic hysteresis loop, electric hysteresis loop, resonant frequencies of electromechanical radial mode resonances and electromechanical radial mode coupling factors. For ferrite type mode resonances of Ni-Zn ferrites and garnets have been investigated. For piezoelectric materials two types of ferroceramic materials PZT type doped by Mg and Nb and modified by

- [Pro1.7] Mn/Ni oxides were measured. Appropriate measuring heads were designed and constructed for the above experiments. Results of experiments will be used in electronic material expert system.
- [Pro1.8] **Modelling And Studies Of New Laser Materials Activated By Holmium Ions** (Modelowanie i badanie nowych dielektrycznych ośrodków laserowych domieszkowanych jonami holmu), sub-project leader: Wiesław Woliński
Holmium ions (Ho^{3+}) doped crystals are well known laser materials for 2 and 3 μm ranges. Much less is known about emission properties of these materials at short wavelengths. The main aim of this study was to investigate spectroscopic and laser properties of Ho^{3+} activated YAG and YAP crystals in the UV, blue and green wavelengths. Different excitation schemes, including up-conversion pumping have been investigated.
- [Pro1.9] **-Modelling Of Parameters Of Metrological Vacuum System Elements** (Badanie parametrów próżniowych podzespołów metrologicznych), sub-project leader: Piotr Szewin
The work was focused on the minimising the uncertainties of Monte Carlo method and its application to Vacuum Metrology. High quality Random Number Generator was implemented to MOLY FLOW.er computer program for calculating conductance of composite vacuum system. The program was then adopted for metrological calculations and allows obtaining results with uncertainty below 10^{-5} .
- [Pro2] **The Development of Processing and Testing Methods of the Electronic Devices and Materials for Microelectronics and Optoelectronics** (Rozwój metod wytwarzania i badania materiałów i przyrządów w dziedzinie mikroelektroniki i optoelektroniki) project leader: Andrzej Pfitzner, May 1999 - May 2000, sub-projects:
- [Pro2.1] **Application of Monte-Carlo method in precision calculation of vacuum metrological systems properties**, (Zastosowanie metody Monte-Carlo do precyzyjnych obliczeń w układach metrologicznych) sub-project leader: Piotr Szewin, co-workers: Marek Niewiński, June 1998 - May 1999
The calculation's attempt of vacuum conductance of some typical components and metrological elements is made to achieve the precision on the level 10^{-5} .
- [Pro2.2] **Development of Internet-based CAD tools** (Rozwój narzędzi wspomagania projektowania wykorzystujących internet), sub-project leader: Wiesław Kuśmicz
This work is the first step toward the Internet-based "virtual manufacturing". The problem of statistical design of IC cells, with special emphasis on analog IC design and device mismatch is addressed. A statistical CMOS process/device simulator accessible via user-friendly Web interface has been developed. The process is simulated in a statistical (Monte Carlo-type) loop with all kinds of variations, inter-die and intra-die, random and deterministic, taken into account. The input data includes device channel dimensions, orientations and positions on the chip. A statistical sample of chips is simulated. The outputs include SPICE model files with individual models for all simulated devices and a statistical file. A statistical postprocessor provides statistics of model parameters including correlations and mismatch. These data can be used for verification of manufacturability and optimization of IC designs. The user does not need to know the processing details and has no access to confidential manufacturing-related information.
- [Pro2.3] **Elaboration and Realization of Sub-assemblies for Radio-optical Link** (Opracowanie koncepcji i wykonanie elementów łączy radiowo-optycznego), sub-project leader: Bogdan Galwas
The work includes researches of short-distance three-channel optical-microwave link with subcarrier multiplexing for transmission digital and/or analog data between points of industrial measurement systems. The optical fiber link operates with Fabry-Perot laser diode at 1300 nm, multimode fiber and PIN photodiode receiver. From microwave point of view three carriers with frequencies 600 MHz, 800 MHz and 1 GHz were chosen.
- [Pro2.4] **Implementation of 5 new Random Number Generators into Moly Flow.er® software** (Implementacja 5 nowych generatorów liczb losowych do programu Moly Flow.er®), sub-project leader: Piotr Szewin, co-workers: Marek Niewiński, June 1998 - May 1999
To have a small uncertainty of computation in Monte Carlo method, it is important to consider not only a very large number N of simulated molecules but also a good quality of a random number generator (RNG) characterised by suitable period length, good uniformity and low resolution. To ensure such a condition the new RNG based on algorithms published lately have been implemented. These RNG are :
- 1: based on an algorithm which is a combination of a Fibonacci sequence and an "arithmetic sequence" (using the subtraction).
 - 2,3: two version of Multiple Recursive Generator
 - 4: Tauworth Generator
 - 5: Mersenne Twister Generator
- [Pro2.5] **Investigation of thermally evaporated hollow-cathode He-Zn lasers** (Badanie lasera w próżni He-Zn z ośrodkiem aktywnym wytwarzanym termicznie), sub-project leader: Tadeusz Adamowicz, co-workers: Krzysztof Dziściołowski, Wojciech Kwaśniewski
Two short (10 cm active length) metal-ceramic tubes provided with cylindrical HC capable of withstanding the heating temperature up to 650°C were constructed. Laser action on blue lines and several infrared lines was studied. Output power and small-signal gain as a function of discharge current, buffer gas pressure and temperature of the zinc reservoir were measured. Optimal operating conditions for each of laser lines were found.

- [Pro2.6] **Lead-free solder and solder pastes for high temperature applications** (Luty i pasty bezołowiowe do pracy w podwyższonych temperaturach) sub-project leader: Ryszard Kisiel, co-workers: Jerzy Kalenik, Krystyna Lachowska, Zbigniew Szczepański, Ryszard Biaduż, Krystyna Szyłko
 The aim of the work was to investigate the electrical and mechanical properties of lead-free solder joints for high temperature applications.
- [Pro2.6] **Solder Sn95.5Ag4Cu0.5 was chosen for investigation in bulk as well as in paste form. For realise the goal of the work a prototype machine for measure the mechanical properties of joints onto PCBs was build. The force range 0 – 200 N with accuracy 0,1 N and displacement range 0 – 150 mm with resolution 0,1 mm was achieved for this machine.**
 The following technological parameters for lead-free solder paste were investigated: printability and wettability. It was found that mentioned above parameters are on acceptable level.
 The mechanical and electrical properties of lead-free solder joints were investigated in room as well as in temperature 120°C before and after long time storage in temperature 120°C. After the storage the joints at high temperature the mechanical and electrical properties, measured in room temperature, were improved. The performance of SnAgCu joints at 120°C was also good, especially the shear and tensile strength for 1206 components onto PCB were better than for SnPb solder.
- [Pro2.8] **Putting into operation and calibrating techological process realized in new cleanliness standards** (Uruchomienie i przeskalowanie procesów technologicznych realizowanych w nowym standardzie czystości), sub-project leader: Romuald B. Beck, co-workers: Andrzej Jakubowski, Jan Szmidt, Bogdan Majkusiak, Małgorzata Jurczak, Tomasz Janik, Aleksander Werbowy, Krzysztof Domański, Agnieszka Zarzba, Andrzej Wojtkiewicz, Witold Ciemiewski, Kazimierz Dalbiak, Małgorzata Trzaskowska
 The main aim of this work was to achieve full processing abilities in the clean-room laboratory after its complete upgrading and rebuilding. The scopes would be twofold: technical, namely: rebuilding the infrastructures of vacuum, gas supply, compressed air, deionized water system and technological, namely: scaling the high temperature processes (oxidation dry and wet, and high temperature diffusion), optimization of photolithography processing (choice of photoresist, developer and exposure and developing time) and others.
- [Pro2.9] **Texture Analysis System** (System analizy tekstur), sub-project leader: Hanna Górkiewicz-Galwas, co-workers: Jerzy Domański, Bartosz Dudziński, Grzegorz Kukielka, Ryszard Pajżk
 The aim of the work was to create computer system for analysis of the digital texture images and for assessment of discriminative and classificative features of the algorithms adequate for pattern recognition. Several algorithms have been implemented in Khoros – a digital signal processing environment running under Linux operating system. Testing of the implemented algorithms was the main goal of the research project. The special digital image textures database has been created. The results of the testing procedures for textures taken from the database have been described.
- [Pro3] **Analysis of light generatio in cyrcular planar DFB/DBR lasers with second order grating** (Analiza generacji promieniowania w laserach DFB/DBR pracujących na drugim rzędzie ugięcia siatki o symetrii kołowej), project leader: Paweł Szczepański, co-workers: Tomasz Kossek, Michał Malinowski, Agnieszka Mossakowska-Wyszyńska, Anna Tyszk-Zawadzka, June 1998 - June 1999
 Cyrcular planar DFB/DBR lasers with the second order grating were studied. Threshold gain and resonance frequencies of the laser modes were studied as a function of the characteristic parameters of the laser structure. Conditions for the single frequency operation were defined. Model of the nonlinear operation of this kind of lasers was developed. Laser characteristics revealing an influence of the structure parameters on the optimal coupling were obtained.
- [Pro4] **Analysis of the Influence MOS Transistor Structure Parameters and the Gate Signal On Charge Pumping Current** (Analiza wpływu parametrów tranzystora MOS oraz sygnału bramki na prąd pompowania ładunku), project leader: Lidia Lukasiak, co-workers: Andrzej Jakubowski, Sławomir Szostak, June 1998 - June 1999
 The aim of this research project was to analyse the influence of signal and structure parameters on the result of charge pumping measurement. In the case of three-level charge pumping the analysis required an appropriate mathematical model of the charge pumping phenomenon to be developed. Comparison of theory with the experimental indicates that the model is in good agreement with the results of measurements.
- [Pro5] **Automation Of Operation And Spectrum Recording In Auger Spectroscopy**, project leader: Marek Niewiżski, June 1998 – June 1999.
 The software named Skanpik has been designed and written. It controls the data acquisition card ACL-8316 AdLink Technology Inc. The program allows: defining experiment by setting its parameters (operating range of analysed energy 0-2500 eV, rate of data acquisition 1-30 eV/s, step 0,5-2 eV, frequency and amplitude of modulation signal); setting sequence of experiments in which they should be realized and collecting data in chart format. The ACL-8316 is high resolution and high performance DAQ card based on 16 bit PC/ISA bus architecture. It has the following base futures: 16 bit resolution, on board 1k FIFO, 16 input channels, 2 output channels, up to 100 kHz sampling rates.
- [Pro6] **Bonding Technologies for Silicon Sensor Structures to Silicon Support** (Opracowanie technologii dołączania krzemowych struktur czujnikowych do podstawek krzemowych), project leader: Zbigniew Szczepański, June 1998 - June 1999
 Silicon to silicon bonding process has evident advantages, since silicon sensor chip and silicon support have the same thermal expansion coefficient. This way stress will come only from thin interlayer which bonds silicon chip and silicon support.
 Following bonding technologies were taken into account:
 -eutectic bonding,
 -silicon to silicon anodic bonding,
 -low temperature glass bonding.
- [Pro7] **Elaboration Of Microwave Dielectrometers With Conical Waveguide Below Cut-Off**, project leader: Jerzy Piotrowski, June 1998 – June 1999.
 The project was dedicated to elaborate theoretical background as well as numerical and experimental tool for microwave wideband dielectrometers in which material under test is placed in conical waveguide below cut-off.

- [Pro8] **Frequency Properties of Piezoelectric Resonators with Axial Symmetry** (Analiza własności cząstotliwościowych osiowosymetrycznych rezonatorów piezoelektrycznych), project leader: Jerzy Krupka, co-workers: Mikołaj Baszun, Leszek Ksiśsek, Dariusz Grzśda, Jerzy Rudkowski, June 1998 - June 1999
 In the work the frequency properties of piezoelectric resonators were calculated and measured. The finite element numerical method implemented in ANSYS software have been adopted for calculation of input admittance and acousto-electric coupled fields spatial distributions. The computer simulations have been done for complex transducer structure: multimaterial, inhomogeneous, anisotropic and showing axial symmetry. Good agreement between theoretical predictions and the measured results have been obtained. The work results could be useful during design of ultrasonic air transducers for robotic applications.
- [Pro9] **Investigation And Modelling Of The Electron Wave-Function Effects In The Metal-Insulator-Semiconductor Structures**, project leader: Bogdan Majkusiak, co-workers: Tomasz Janik, Jakub Walczak, June 1998 – June 1999.
 The theoretical model of tunnel currents in MOS structures was developed and used for theoretical investigations of the Fowler-Nordheim tunnel current oscillations. The Al-SiO₂-Si(p) test structures were fabricated and the tunnel current was measured and analysed in the Fowler-Nordheim tunnelling regime. The FN current oscillations were experimentally observed. The theoretical model of resonance tunnelling in the system: “energy gap of Si - potential well in the semiconductor surface region - energy gap of SiO₂ - metal” was developed and used for theoretical investigations.
- [Pro10] **Investigation of Influence of Doping on the Parameters of Amorphous Silicon Thin Film Transistors** (Badanie wpływu domieszkowania na parametry tranzystorów cienkowarstwowych z krzemu amorficznego), project leader: Stanisław M. Pietruszko, co-workers: Michał Urbański, Marek Marczuk, Leszek GŚgała, June 1998 - June 1999
 The transfer and output current-voltage characteristics of thin film transistors at different temperatures were investigated. The active layer of TFT (amorphous silicon) were doped with different chlor concentrations (4, 6, 8 and 12 at.%). It was found that CL increases threshold voltage, flat band voltage and decreases conductivity of amorphous silicon.
- [Pro11] **Investigation of Lightwave Properties of Thin Ta₂O₅ layers** (Badanie własności światłowodowych warstw Ta₂O₅), project leader: Jerzy Kruszewski, co-workers: Marek Gutkowski, June 1998 - June 1999
 The method of Ta₂O₅ thin film production by reactive sputtering was elaborated. Different integrated optoelectronic structures has been realized: lightwave paths, Y-type splitters and planar lenses. The absorption of manufactured light waveguides was on the level of 20dB/cm. It was demonstrated that thin film dividers and lenses functioned properly.
- [Pro12] **Investigations Of Ageing Phenomena In Thermistor Ceramics**, (Badanie zjawisk degradacji w ceramice termistorowej), project leader: Julitta Pogorzelska, co-worker: Józef Maciak, June 1998 – June 1999.
 The ageing experiments at the extremum exploitation conditions were carried out. Electrical parameters of NTC thermistors were measured during the ageing process. These results were connected with structural changes of ceramics. Obtained data will be used to the development of universal ageing model for multicomponent ceramic materials
- [Pro13] **Mathematical Morphology And Its Application To Image Segueure Segmentation And Tracking**, project leader: Grzegorz Kukielka, June 1998 – June 1999.
 Its described use of rector mathematical morphology to image segueure segmentation and tracking. In this work the general n-dimensional mathematical morphology theory is presented. The proposition of application of our method of moving object tracking is described.
- [Pro14] **Non-equilibrium States in Capacitance-Voltage Characteristics Measurement** (Problemy zjawisk nierównowagowych w pomiarach charakterystyk pojemnościowo-napiściowych), project leader: Romuald B.Beck, co-workers: Andrzej Jakubowski, Agnieszka Zarśba, Andrzej Wojtkiewicz, Tomasz DŚbski, Kazimierz Dalbiak, Witold Ciemiewski, June 1998 - June 1999
 The aim of this work was to study the possibilities of obtaining the equilibrium state during the measurement of capacitance-voltage characteristics (high frequency). The illumination time of the structures to be measured and appropriate delay time has tombe established be means of additional C-t measurement (in order to avoid unnecessary long measurement). The method has been successfully proved on MOS devices with very good quality interface as well as with poor quality devices (MOS-SOI).
- [Pro15] **Plasma Etching of Thin Nitride Films** (Plazmowe trawienie cienkich warstw azotków), project leader: Jan Szmidt, co-workers: Aleksander Werbowy, Kazimierz Dalbiak, Witold Ciemiewski, Małgorzta Trzaskowska, June 1998 - June 1999
 There were made attempts of BN, AlN, GaN thin films by means of radio frequency plasma (13,56 MHz). The best effects were obtained in air plasma. Analysis of results indicates relatively high efficiency of etching in this mixtures. The predominant mechanism of etching was physical sputtering of processed material.
- [Pro16] **Porous Silicon – remarkable material for microelectronic, optoelectronic and micromechanical applications** (Porowaty krzem – intrygujący materiał dla zastosowaś w mikroelektronice, optoelektronice i mikromechanice), project leader: Romuald B. Beck, co-workers: Krzysztof Domaśski, Emilian Pótrolnik, Witold Ciemiewski, Kazimierz Dalbiak, June 1998 - June 1999
 An investigation of basic properties of porous silicon were carried out. We consider this material as candidate for sacrificial layer in micromechanical structure, buried oxide in FIPOS structure and blue light emitting device. The possibilities of integration of various kinds of porous silicon based devices is briefly discussed.
- [Pro17] **Preparation of a process of producing Ta₂O₅ layers on a silicon substrate** (Opracowanie procesu wytwarzania warstw Ta₂O₅ na podłożu krzemowym) project leader: Kruszewski Jerzy, co-workers: Gutkowski Marek, Majkusiak Bogdan, ElŚbieta Jezierska, June 1998 - June 1999
The subject of this study was the preparation of the process of producing thin Ta₂O₅ layers as an alternative to SiO₂ layers in the MOS devices. The scope of the work included: producing Ta₂O₅ layers by a reactive sputtering on Si substrates, the conducting of structural investigation in connection with ellipsometry investigation, production of trial MOS structures and the investigation of their electrical properties. The highest values of the refractive index of very thin layers Ta₂O₅ were reached with very low pressure of sputtering gas in the order of (5,7)x10⁻⁴ mbar and with very low amounts of oxygen in the gas - up to 15%. The results of the studies of the microstructure clearly show the amorphous and uniform character of the layers.

- [Pro17] Microanalysis of the chemical composition has shown an excess of oxygen atoms and the existence of non-saturated Ta-O bonds. The results of the measurements of the current - voltage and the capacitance-voltage characteristics of the trial structures in the Al-Ta₂O₅-Si configuration have shown the presence of a space continuous dielectric structure even in the case of the thinnest of the studied layers. A connection between a change of the histogram of breakdowns and an increase of voltage on the target was not observed, but an increase of oxygen presence in the sputtering gas caused a decrease in the breakdown parameters of the layer
- [Pro19] **Realization of building blocks of specialized microprocessor for intelligent defibrillator control**, (Realizacja bloków funkcjonalnych specjalizowanego mikroprocesora do sterowania inteligentnym defibrylatorem), project leader: Wiesław Kuźmicz, co-workers: Zbigniew Jaworski, Adam Wojtasik, Marcin Sadowski, Andrzej Wąkanis, Andrzej Wielgus, 1999
 ___The goal of the project was to design main modules of specialized micro-controller to be used in a new concept of defibrillators. Two approaches have been tried: purely digital and mixed mode. In both the cases one of the most important feature of the design was low power consumption. To achieve that a modern sub-micron technology (AMS 0.35 um) have been chosen. The main result of the project is the test chip, which contains two independent blocks. One of them is a complete digital single-input single-output fuzzy controller with programmable transfer curve and programmable limitation of output signal dynamics. The second block is the analog part of three-input single-output fuzzy controller based on digitally controller current mirrors.
- [Pro20] **Studies Of Interionic Interactions In Ho³⁺ Activated Laser Materials**, project leader: Michał Malinowski, June 1998 – June 1999.
 We report the optical properties of Y₃Al₅O₁₂ (YAG) and YAlO₃ (YAP) crystals doped with Ho³⁺ ions. Visible emissions from the ³D₃ (at about 33000 cm⁻¹)₁ ⁵S₂ (18500 cm⁻¹) and ⁵F₅ (15500 cm⁻¹) excited states and IR emissions from the ⁵I_J levels have been characterised under pulsed one-photon excitation and the experimental lifetimes for these levels have been compared with those obtained theoretically by using Judd-Ofelt approach. Cross-relaxation mechanisms responsible for concentration quenching of the ³D₃ and ⁵S₂ emissions and upconversion processes for achieving blue and green fluorescence under one-colour red and IR have been investigated.
- [Pro21] **Study of thermally heated pulsed HCD He-Zn ion laser**, project leader: Tadeusz Adamowicz, co-workers: Krzysztof Dziżciołowski, Wojciech Kwaźniewski, June 1998 – June 1999.
 Two designs of laser hollow cathode discharge (HCD) tube were investigated - a glass tube with helical HCD cathode and ceramic-metal tube with a cylindrical cathode. Lasing on several transitions in visible and IR region was obtained. The dependence of the laser power on the excitation parameters, gas pressure and temperature of Zn reservoir was investigated. Stable laser operation was observed when the excitation pulses repetition rate was increased up to 1000Hz. Small-signal gain for Zn II IR line 758,8nm and blue 492,4nm lines was 100%/m and 30%/m, respectively.
- [Pro22] Analysis of tree structures in medical images (Analiza struktur drzewiastych w obrazach medycznych), project leader: Hanna Górkiewicz-Galwas, co-workers: Jerzy Domański, May 1999 – May 2000
 ___This research project concerns the analysis of digital medical images of the tissue with the net of blood vessels caused by disease process. The special feature of the blood vascularity is its tree structure. The main objective of the project has been the development of the detection process by means of the texture analysis. The new algorithms of the analysis based on the Local Principal Component Analysis enhanced of Rough Set methodology have been elaborated.
- [Pro23] Assembly Process for Silicon Structures with Gold and Solder Bumps (Opracowanie technologii dołączania struktur półprzewodnikowych z kontaktami podwyższonymi) project leader: Zbigniew Szczepański, July 1999 - May 2000
 ___Flip chip technology has recently gained increasing importance and its application is expected to increase significantly in the next years.
 ___In particular flip chip technology is expanded for Laminates substrates due to such application as MCM-L, CSP, BGA.
 ___In our studies to make easier flip chip structures fabrication, instead of silicon structures, ceramic and glass structures with gold bumps were designed and fabricated. Such structures were bonded to organic substrate using adhesives and solder pastes. The connected resistance of the bonded bumps before and after thermal test was measured.
- [Pro24] **CMOS implementation of electronic circuits for spread spectrum communication based on chaos generators**, (Implementacja układów do łączności szerokopasmowej wykorzystujących generatory drgan chaotycznych w technologii CMOS), project leader: Witold Pleskacz, co-worker: Mirosław Grygolec, July 1999 - May 2000
 ___The project deals with the new idea of more robust and secure communication by using chaotic generators. The main goals of this work are: a) theoretical analysis of chaos generators and the design of circuits that satisfy the conditions for chaos generation and communication; b) full custom CMOS design and fabrication of considered electronic system.
- [Pro25] Microscopic image analysis and recognition system (System analizy i rozpoznawania cyfrowych obrazów mikroskopowych), project leader: Jerzy Woźnicki, co-workers: Grzegorz Kukielka, Bartosz Dudziński, Ryszard Pajżk, May 1999 – May 2000
 ___The purpose of the project is to develop a universal image analysis and recognition system of microscopic images. To evaluate the results of the various experiments, the project requires quantitative analysis of large amounts of microscopic pictures. This makes automatic or almost automatic image analysis methods necessary. These range from basic segmentation methods, various colors within the sample are determined. There are several features used that can characterize structures in biological samples like size distribution, and spatial distributions of various spots to developing both measures and measuring methods. The novelty of this project is that sample preparation methods will be developed in close co-operation with image analysis methods, to get stable and objective results. The digital image analysis involves segmentation and extraction of objective distribution measures of objects. The system is used for digital computer analysis of tumour-induced angiogenesis on an animal model.

- [Pro26] **Modeling of static characteristics and parameters of SiGe devices** (Modelowanie charakterystyk i parametrów przyrządów półprzewodnikowych z krzemogermanu), project leader: Andrzej Jakubowski, co-workers: Bogdan Majkusiak, Tomasz Janik, Lidia Łukasiak, Andrzej Wojtkiewicz, Krzysztof Braclawski, June 1999 - May 2000
 The goal of this research project was to model static characteristics of SiGe devices, mainly heterojunction bipolar transistors (HBT) and MOS transistors. The developed models enabled the influence of several parameters on the device characteristics to be analyzed. The investigated parameters included e.g. distribution of Ge in the base of a HBT, base doping, SiGe gate (its influence on MOSFET threshold voltage).
- [Pro27] **Optical and laser properties of highly rare earth doped Re^{3+} :YAG/YAG planar waveguides** (Badanie właściwości optycznych i generacyjnych silnie domieszkowanych warstw światłowodowych RE^{3+} :YAG/YAG), project leader: Michał Malinowski, co-workers: Paweł Szczepański, Marcin Kaczkan, Ryszard Piramidowicz, Artur Wnuk, 1999 - 2000
 Planar optical devices play an increasingly important role as the components for fiberoptic communication systems. One of the recent important developments is the successful operation of IR planar waveguide amplifiers and lasers which could be easily coupled to fiber components. Compact waveguide lasers that operate in the blue region of the visible spectrum offer broad range of special and commercial opto-electronic applications, such as complex data transmission and interpretation, full-colour displays and colour printing.
 In this project optical and laser properties of highly doped epitaxial YAG waveguides on YAG substrates are investigated.
- [Pro28] **Technological conditions of plasma synthesis of silicon carbide (SiC) films on silicon (Si)** (Warunki technologiczne wytwarzania warstw węgla krzemu (SiC) metodami plazmowymi na powierzchni krzemu (Si)), project leader: Jan Szmidt, co-workers: Małgorzata Jurczak, Aleksander Werbowy, Witold Ciemiewski, Kazimierz Dalbiak, Małgorzata Trzaskowska, June 1999 - May 2000.
 The goal of this work is determination of technological conditions of plasma synthesis of silicon carbide films as well as their successful deposition on silicon and silicon carbide substrates.
 There are investigated structural, electrophysical and mechanical properties of obtained material. There are also made attempts of fabrication and characterization of simple electronic structures (e.g. MIS) with synthesized SiC layers.
- [Pro29] **The influence of MOS/SOI transistor channel dimensions on carriers mobility** (Wpływ rozmiarów kanału tranzystora polowego MOS/SOI na ruchliwość nośników), project leader: Bogdan Majkusiak, co-workers: Jakub Walczak, Tomasz Janik, June 1999 - May 2000
 The aim of the work is development of a computer model and program for calculation of carriers mobility in the MOS/SOI transistor channel considering quantization of energy effects. It was necessary to develop two versions of the program – the first one for MOS transistor and the second one for double-gated SOI transistor to isolate quantization of energy effects in the surface inversion layer and quantization of energy due to very low thickness of the semiconductor layer.
 The calculations using the programs allowed to carry out theoretical analysis of semiconductor layer thickness of MOS/SOI transistor influence on the effective mobility in the channel, starting from theoretically infinite thickness (conventional MOS transistor) up to several nanometer range (MOS/SOI transistor) and to come to practical conclusions as far as designing of MOS/SOI circuits is concerned.
- [Pro30] **Ultrathin silicon dioxide (SiO_2) and high – K dielectrics layers (manufacturing and characterization)** (Ultracienkie warstwy dwutlenku krzemu (SiO_2) i dielektryków o wysokiej stałej dielektrycznej (wytwarzanie i charakteryzacja)), project leader: Romuald B. Beck, co-workers: Krzysztof Domański, Marek Gutkowski, Andrzej Jakubowski, Tomasz Janik, Lidia Łukasiak, Bogdan Majkusiak, Jan Szmidt, Aleksander Werbowy, Sławomir Szostak, Witold Ciemiewski, Kazimierz Dalbiak, Małgorzata Trzaskowska, June 1999 - May 2000
 The main aim of this work was to scale the dry oxidation down to the range of ultrathin oxide layers thickness. The pressure was put to obtain the high quality layers, thus, all the efforts have been made to stay in the high oxidation temperature regime (about 1000°C). The obtained layers properties were examined by electrical characterization methods using MOS capacitor / diode and MOSFET as test tool. First attempts of testing PECVD method, from the process controlability point of view as an alternative method of oxide but also nitride layers formation were also made.

4.2. Projects Granted by the State Committee for Scientific Research (KBN)

- [Pro31] **Formation Of SOI (Silicon-On-Insulator) Structures On Silicon Wafers With An Epitaxial Layer Deposited On Porous Silicon (FIPOS)** (Wytwarzanie struktur SOI (krzem na izolatorze) na płytkach krzemowych z warstwą epitaksjalną osadzoną na warstwie porowatego krzemu (FIPOS)), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Romuald B. Beck, co-workers: Krzysztof Domański, Andrzej Jakubowski, Tomasz Janik, Małgorzata Jurczak, Lidia Łukasiak, Bogdan Majkusiak, Emilian Półrolnik, Jan Szmidt, Witold Ciemiewski, Kazimierz Dalbiak, Artur Samulski, Małgorzata Trzaskowska, September 1996-June 1999;
 —Among the few still competing options for SOI substrates formation, the FIPOS seems to be particularly attractive. It requires however, many optimisation processes, as the porous layer formation, epitaxial layer deposit, porous layer thermal oxidation and even later processing steps have considerable impact one on another. In the first stage of the project (it is only the beginning of this project) the work has been concentrated on obtaining the first FIPOS substrates. The results prove that the morphology of the obtained pores has enormous impact on the kinetics of the layer oxidation. Their morphology, however depends on the parameters of all the preceding high temperature steps. Thus, the optimising procedures have to cover the whole sequence and not a few individual steps only.

- [Pro32] **Methods for the Characterisation of SOI Materials and Devices** (Metody charakteryzacji materiałów i przyrządów SOI), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Andrzej Jakubowski, co-workers: Bogdan Majkusiak, Małgorzata Jurczak, Lidia Łukasiak, Tomasz Janik, Romuald B. Beck; October 1996 - June 1999
 ___The aim of the project is to create an efficient methodology for the characterization of SOI materials and devices which could serve to assess reliability. The ~~teams~~ ~~workers~~ carrying out this project has at its disposal SOI test structures (designed and fabricated in co-operation with National Microelectronics Research Centre, Cork, Ireland) and SOI substrates. The project aims to develop a system for the characterization of SOI materials and devices which will include: analysis of current-voltage and capacitance-voltage-time characteristics, charge pumping investigations, analysis of large-signal (e.g. relaxation of drain current) and small-signal (e.g. transconductance, carrier lifetime) properties, extraction of oxide thickness, doping concentration, active layer thickness, mobility, parasitic resistances, characteristic voltages of a MOS structure (flat-band voltage, threshold voltage), characterization of degradation processes in oxide layers.
- [Pro33] **Elaboration Of Fibre Optic Amplifiers At The Range 1060nm For Laser Range-Finder And At 1530nm Pumped By Laser Diodes** (Opracowanie wzmacniaczy włóknowych na zakres 1060 nm dla dalmierza laserowego i na 1530 nm pobudzanych diodami laserowymi), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Wiesław Woliński, May 1997 – October 1999
 ___The aim of the problem is an investigation of the amplification conditions of small signals, going from open space in active multimode fibers. Active media are silica fibers, Er doped for wavelength of 1530nm and Nd doped for the 1060nm signal. Laser diodes emitting 980nm and 810nm radiation have to be used for fibers pumping. As a result of the work the models of amplifiers will be realized. The amplifier on the 1060nm wavelength is provided for laser range-finder.
- [Pro34] **Researches On Metal Ion Lasers For Ultraviolet Laser Generation** (Badania laserów jonowych na parach metali dla generacji w obszarze nadfioletu), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Tadeusz M. Adamowicz, co-worker: Wojciech Kwamniński, July 1997 - October 1999
 In the present research project several types of noble gas - metal vapour ion lasers operating in UV, visible and IR regions were investigated. The study concerned sputtered metal ion lasers with segmented (SHC), or helical, (HHC), hollow cathodes, such as He/Ne-Au, He-Ag, He/Ne-Cu and He/Ne-Zn. Using a novel method a spatial distribution of small-signal gain was measured for different excitation and filling parameters, and hollow cathode configurations. This kind of measurements gives the insight about the effectiveness of the charge-transfer (C-T) reaction which is responsible for pumping of upper laser levels for most of the above lasers.
 A new method was developed to determine diffusion coefficients of metal atoms in noble gases. This method can be applied to every sputtered metal atom - noble gas system created in a hollow cathode discharge, (HCD), in which the C-T collisions occur, and particularly to the sputtered metal ion HCD lasers where the knowledge of this parameter is of the great importance. Using this method the diffusion coefficient of Au atoms in He was measured.
 Influence of ³He isotope on lasing performance in sputtered metal ion He-Cu and noble gas mixture He-Kr lasers was investigated. For the He-Cu laser a 15% increase in lasing efficiency was obtained. However, due to lower discharge voltage in ³He, and consequently lower sputtering rate, the gain and output power were similar for both gases. For the He-Kr ion laser a rise of small-signal gain and output power up to about 30% and 50%, respectively, was observed. It is believed that using He isotope in He-Cd., He-Se and He-Zn lasers with thermally evaporated medium can significantly improve their performance.
- [Pro35] **Studies On Laser-Diode Excitation And Construction Of Planar Waveguide Nd:YAG/YAG Lasers** (Opracowanie metod wzbudzenia, podzespołów i konstrukcji falowodowych laserów cienkowarstwowych Nd:YAG/YAG pobudzanych diodami laserowymi), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Michał Malinowski, May 1997- October 1999
 ___The main goal of this work is to elaborate planar waveguide laser with Fabry-Perot or distributed feedback resonator. The project concerns technology by liquid phase epitaxy (LPE) of waveguiding thin active films of neodymium (Nd) doped YAG on YAG substrates. Optical waveguiding is obtained by co-doping with Lu and Gd ions. Further studies involve investigation of the spectroscopic properties of the material, technology of the grating structures and laser experiments.
- [Pro36] **Fibre optics amplifier's elaboration for 1.06mm laser range meter and for 1.53mm pumped by laser diodes PBZ-32-10, Task 4**, (Zadanie 4, pt: Opracowanie wzmacniaczy włóknowych na zakres 1.06mm dla dalmierza laserowego i na 1.53mm pobudzanych diodami laserowymi), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader Jerzy Kruszewski, co-workers: Maria Bełłowska, Michał Borecki, April 1997 - June 2000
 ___Nowadays optical fibre amplifiers are widely used. Basic amplifier parameter is gain. There are many theoretical problems when the amplifier is constructed. There are many publications that present the single mode erbium doped fibre amplifiers pumped co-directionally, and there is very little information available about multimode amplifiers, and about amplifiers pumped in other way example: contra-directionally. Singlemode amplifier gain identification is known. The aims of this work were construction of multimode fibre amplifier model then analysis of amplification and noise effects. On this basis the laboratory amplifier model should be constructed.
- [Pro37] **A Verification Method for Analytical Models of Doping in Manufacturing of VLSI** (Metoda weryfikacji analitycznej modeli domieszkowania dla technologii wytwarzania submikrometrowych układów VLSI), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Adam Lejman, April 1998 - April 1999
 The research examined semi-empirical models as a way of fast and accurate modelling for statistical purposes in submicron technology manufacturing process. The model output was compared to fully numerical modelling in order to evaluate criteria of constructing and tuning the model to match reference numerical profiles. Modelling experiment was led to verify the usability of semi-empirical model. Obtained results showed very similar histograms of physical parameters in both simulation cases: fully numerical and using semi-empirical models.

- [Pro38] **Analysis of Delay Lines with Interdigital Transducers for Liquid Sensors Applications** (Analiza linii opóźniających z przetwornikami międzypalczastymi do zastosowań czujnikowych w cieczach), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Mikołaj Baszun, Sylwester Gawor, Leszek Księżek, Dariusz Grzda, Paweł Milewski, Lucjan Nafalski, Jerzy Rudkowski, July 1998 - December 1999
 ___The main tasks of this project are:
 - theoretical analysis and software tools design for modelling of delay lines with interdigital transducers for different modes of the shear horizontal surface acoustic waves;
 - design of microelectronic structures for delay lines to obtain high values of electromagnetic/acoustic energy coupling coefficients;
 - application of such delay lines as liquid sensors and research their basic characteristics.
- [Pro39] **Designing And Verification Method Of The Reference Structure Of Submicrometer MOS Transistor For Analytical Models** (Metoda projektowania i weryfikacji wzorcowej struktury submikrometrowego tranzystora MOS dla konstruowania fizycznych modeli elektrycznych.), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Jacek Laskowski, February 1998 - February 1999
 A method of designing and verification of reference structure for the submicrometer MOS transistor is proposed. The structure obtained in such a way makes accessible device electrical characteristics that are usually not presented in literature providing details of internal device structure the same time. Thus it allows to develop and evaluate analytical MOS models, particularly for statistical simulation purposes.
- [Pro40] **Modulation And Controlling Of Microwave Circuits By Means Of Optical Radiation** (Badania metod modulacji i sterowania układami mikrofalowymi z wykorzystaniem promieniowania optycznego), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Bogdan Galwas, co-workers: Jerzy Piotrowski, Jerzy Skulski, Andrzej Krzysztofik, Jarosław Dawidczyk, Zenon Szczepaniak, March 1998 - December 1999
 ___The main aims of the Project are focused on:
 - investigation of modulation of microwave oscillator by means of an optical signal,
 - method of transmission of microwave signals by optical transmission lines,
 - controlling of microwave circuit's parameters by means of optical signals.
- [Pro41] **The Elaboration Of Design Methods And Realisation Of New Microwave Filters With Dielectric Resonators For Telecommunication And Cellular Telephony** (Opracowanie metod projektowania i wykonanie nowych typów filtrów mikrofalowych z rezonatorami dielektrycznymi dla telekomunikacji i telefonii komórkowej), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Jerzy Krupka, Adam Abramowicz, Krzysztof Derzakowski, Zbigniew Rutkowski, January 1998 - December 1999
 The aim of the project is elaboration of design methods of new microwave filters with dielectric resonators for telecommunication and cellular telephony and their practical realisation. The tuneable and untuneable filters have been elaborated. Tuneable filters will be tune mechanically in very wide range and electronically by means of ferrite elements. Untuneable filters will be narrow-band with very high quality factor.
- [Pro42] **Vacuum Controller for the pressure range 10^5 - 10^{-10} Pa** (Opracowanie próżniomierza jonizacyjnego na zakres 10^{-10} - 100000 Pa z mikroprocesorowym układem kontrolnym), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Piotr Szewin, June 1998 - May 1999
 Three gauges: convection, Pirani and nude modulated Bayard Alpert all in UHV technology will be constructed as a pressure transducer within the project as well as programmable electronic supply and measuring unit.
- [Pro43] **Application Of A Coaxial Line - Waveguide Below Cut-Off Transition For Microwave Methods Of Dielectric Measurements** (Zastosowanie połączenia linia współosiowa - podkrytyczny falowod kołowy w mikrofalowych metodach pomiaru dielektryków), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader Jerzy K. Piotrowski, Bogdan Galwas, Jerzy Skulski, Zenon Grzymała, Barbara Szymulska, August.1998 – January 2000
 ___The coaxial line - circular waveguide transition is studied for use in wideband as well as resonator methods of dielectric measurements. The goal of the project is elaboration of theoretical basis as well as numerical and empirical tools for the above methods.
- [Pro44] **Modelling And Characterization Of Quantum Effects In MOS SOI Devices** (Modelowanie i charakterystyka efektów kwantowych w przyrządach typu MOS SOI), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Bogdan Majkusiak, co-workers: Tomasz Janik, Andrzej Jakubowski, Jan Szmidt, Romuald B. Beck, Lidia Łukasiak, Agnieszka Zareba, Jakub Walczak, Kamil Kosiel, Antoni Siennicki, Józef Maciak, October 1998 - September 2001
 ___The purpose of the project is consideration of consequences of energy quantization and tunnelling effect on electrical characteristics of the metal-oxide-semiconductor devices fabricated in the silicon-on-insulator (SOI) technology. The detailed tasks are: developing a theoretical model of the MOS SOI tunnel diode, consideration of influence of semiconductor body thickness on tunnel current in MOS SOI tunnel diode and the gate and drain currents in MOS SOI transistor, investigation of the effect of energy quantization on operation of an MOS SOI transistor, investigation of resonance tunnelling in MISIM transistor.
- [Pro45] **Applications of porous silicon for fabrication of micromechanical sensors silicon components** (Zastosowania porowatego krzemu do wytwarzania krzemowych elementów czujników mikromechanicznych), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Krzysztof Domański, co-workers: Romuald B. Beck, Witold Ciemiewski, Kazimierz Dalbiak, Małgorzata Trzaskowska, January 1999 - December 1999
 ___The aim of this project is fabrication and characterization of test structures making use of epitaxial layers deposited over porous silicon. All technological processes have to be compatible with MOS technology.
- [Pro45] **Consequently porous silicon which serve for a sacrificial layer has to be etched in nonalkaline solutions. Test structures consisting of cantilever beams, silicon membranes, bridges and wires could be used as components of variety of micromechanical sensors (eg. bolometers).**

- [Pro47] **Charge pumping in SOI structures: modeling and parameter extraction** (Metoda pompowania ładunku w strukturach SOI: model i ekstrakcja parametrów), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Andrzej Jakubowski, co-worker: Sławomir Szostak, September 1999 - October 2000
 The aim of this research project is to build a system for charge pumping analysis of SOI and bulk MOSFETs. Characterization is based on original mathematical description of charge pumping. Genetic algorithms are used to fit theoretical curves to experimental data.
- [Pro48] **The influence of polymer matrix and filler type on adhesive joints performances** (Badanie wpływu wybranych układów polimerów wiążących i napełniaczy na parametry użytkowe połączeń wykonywanych klejami elektrycznie przewodzącymi), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Ryszard Kisiel, co-workers: Jan Felba, Krystyna Bukat, Kazimierz Friedel, Andrzej Mońcicki, Zofia Morawska, Zbigniew Szczepański, Tadeusz Sobierajski, July 1999 - December 2000
 The aim of the project is the investigation of polymer matrix type and filler type on mechanical and electrical parameters of adhesive joints onto PCBs. Such compositions can be used as solder replacement in PCB assembly. Test samples were selected and elaborated for measure the mechanical and electrical parameters of adhesive joints onto PCBs. The blend of silver flakes and semiflakes was selected as the best filler type.
- [Pro49] **Digital image analysis and processing of neovascularization** (Analiza procesów neowaskularyzacji metodami cyfrowego przetwarzania obrazów), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Jerzy Woźnicki, co-workers: Grzegorz Kukielka, Hanna Górkiewicz-Galwas, Jerzy Domański, Bartosz Dudziński, Ryszard Pająk, April 1999 - March 2002
 Angiogenesis is the formation of new blood vessels which occurs in normal physiological conditions. It is also an underlying process in the pathogenesis and invasion of neoplasms. New blood vessels develop from pre-existing blood vessels. Different substances may have an influence on the process. The process of angiogenesis is subject to the effects exerted by pro- and anti-angiogenic factors released by various cells and tissues which, in normal physiological conditions, are maintained in balance. However, a loss of the balance leads to generation or inhibition of neovascularisation.
 The main goal of the project is to assess the effects of various substances on the development of new blood vessels using digital image processing system in co-operation with surgical microscope and Sidky and Averbach criteria (1975). The digital image processing methods introduce automatic quantification of surface, shape and size of new blood vessels.
 The most significant information portrayed visually in the microscopic images refers to physical changes reflecting processes in the new blood vessels as well as their geometry. Hence the first stage is to detect the contours of the objects studied. The method of detecting the contours of new blood vessels is an advanced type of filtration, which may be described as a recursive differential filter (RDF). The method used in the digital computer image processing in order to remove the information about 'large' blood vessels will allow automated quantification of new blood vessels formed in the due course of angiogenesis.

4.3. Projects Granted by International Institutions

- [Pro50] **SOI devices - modelling and characterisation** (Przyrządy SOI – modelowanie i charakteryzacja), National Microelectronics Research Centre, Cork, Irland, project lider: Andrzej Jakubowski. co-workers: Tomasz Janik, Małgorzata Jurczak, Lidia Łukasiak, Jan Gibki, 1995 - 2000
 This research project is devoted to fabrication, modeling and characterization of SOI devices. Currently the cooperation is focused on characterization of thin dielectric films in SOI devices by means of analysis of C-V curves and charge pumping.
- [Pro51] **Modelling and characterization of MOS-SOI devices** (Modelowanie i charakteryzacja przyrządów MOS-SOI), Laboratoire de Physique des Composants a Semiconducteurs (LPCS), Ecole National Supérieure d'Electronique de Radioelectricite Grenoble, Francja, project leader: Romuald B. Beck, 1996 - 1999
 The aim of this project is to combine the efforts in modelling and building characterisation methods that take place in both entities, i.e. in LPCS and IMIO WUT. The cooperation resulted in complex studies of the state-of-the-art. MOS-SOI devices that are produced on the laboratory scale by most advanced companies.
- [Pro52] **Promotion and Simulation of Photovoltaic Energy Technologies – PROSPECT, INCO-COPERNICUS, (ICOP-DISS-2163-96)**, (Promocja i projektowanie energetycznych technologii fotowoltaicznych), NMRC - Irland, Ecole des Mines, ARMINEES - France, ICI - Romania, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Stanisław Pietruszko, January 1997 - December 1999
 The main objectives of this project :
 - promote the usage of the PV simulation software in Eastern Europe based on an existing well established package.
 - expand databases to incorporate the experience of users/providers/researchers of Eastern Europe (e.g. local irradiance data, incorporate models for PV components currently in use in Eastern Europe and which are currently not in database).
 - to model existing PV plants in Eastern Europe, compare results of simulations with existing data for use in verification of models.
 - incorporate improvements to models identified in JOULE II Concerted Action Project, Task 6, Modelling and Simulation.
- [Pro52] - develop an interface adapted for the special requirements of Eastern European countries (e.g. supply HELP files in selected languages, incorporate other identifiable interface issues).
 - combine simulation techniques and design expertise to investigate sizing issues in Eastern Europe. This would involve performing economical assessment, and investigating cost competitiveness.

- [Pro54] **Promotion of Warsaw University of Technology in USA** (Promocja osiągnięć Politechniki Warszawskiej w USA), Carnegie Mellon University, Pittsburgh, USA, project leader: Jan Szmidt, co-workers: Andrzej Jakubowski, Bogdan Majkusiak, Romuald B. Beck, 1997 - 1999
 ___The aim of the project is promotion of achievements of WUT in USA. In particular the cooperation is devoted to research in the area of characterisation of microelectronic structures and materials, as well as modelling and fabrication.
- [Pro55] **Investigations of degradation phenomena in termistors with negative thermal coefficient of resistance**, Scientific Research Company „CARAT” R.&D. Institute for Materials, project leader: Julitta Pogorzelska, co-worker: Józef Maciak, June 1997-June 1999
 ___Aims are development of technology, investigation of physical phenomena in materials during long time period, and the materials with small degradation. It will allow to correct technology of elements.
- [Pro56] **Investigations of degradation effects in functional ceramics and prediction of exploitation properties.** (Badanie zjawisk degradacji w ceramice funkcjonalnej i prognozowanie ich właściwości eksploatacyjnych), Scientific Research Company „CARAT” R.&D. Institute for Materials, project leader: Bohdan Butkiewicz, co-workers: Julitta Pogorzelska, Józef Maciak, July 1998-July 1999
- [Pro57] **Building Integration of Solar Technology** INCO/COPERNICUS (Integracja Technologii słonecznych z budownictwem), project no ICOP-DEMO-4080-98, WIP-Germany, Univ. Targoviste, Romania, Synthesis & Research, Greece, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader Stanisław Pietruszko, October 1998 – October 2001
 Design and installation of active and passive solar systems at the campus of the University of Targoviste in Romania. Design, installation and monitoring of photovoltaic systems.
- [Pro58] **Modelling of thin film transistor and characterisation of DLC layers** (Modelowania tranzystorów cienkowarstwowych i charakteryzacja warstw DLC), National Physics Laboratory, New Delhi, India, project leader: Andrzej Jakubowski, co-workers: Bogdan Majkusiak, Lidia Łukasiak, Małgorzata Jurczak, 1998 - 2000
 ___The project includes two main areas. The first one is modelling of the I-V characteristics of thin film transistors. The devices investigated in the project include fully depleted SOI transistors as well as amorphous- and poly-silicon TFTs. The other area of project is characterisation of thin DLC layers, as well as layers made of the other wide-bandgap semiconductors, e.g. BN and AlN.
- [Pro59] **VILAB: Microelectronics Virtual Laboratory for Co-operation in Research and Knowledge Transfer** (INCO-Project 977133). September 1998-August 2001, project leader: Wiesław Kuźmicz, Project partners are:
 - FhG-IIS/EAS (Germany)
 - Technical University of Budapest (Hungary)
 - Tallin Technical University (Estonia)
 - Warsaw University of Technology (Institute of Microelectronics and Optoelectronics) (Poland)
 - Institute of Electron Technology (Poland)
 - Institute of Computer Systems (Slovakia)
 - Slovak Technical University, Bratislava, (Slovakia)
 - Darmstadt University of Technology (Germany)
 - Linköping University (Sweden)
 The main objective of this project is to set up and maintain an east-West Virtual Laboratory (VL) for promoting co-operative research, development and training activities between the partner institutions in CEE and EC countries in design of dependable microelectronic systems which is one of the most dynamically developing application fields. The main result of the project will be: establishing of a new Research Network called Virtual Laboratory and new co-operative results in design, research and teaching achieved by joint use of resources and environment of the VL.
- [Pro60] **Defect modelling in IC's**, (Modelowanie defektów w układach scalonych), Lvov Technical University (Ukraine), project leader: Wiesław Kuźmicz, 1999
 The aim of the project is to develop new integrated circuit design, simulation and verification methods which take into account random structural defects in these circuits. Works in Lviv Polytechnic include manufacturing process simulation as well as circuit simulation methods while works at Warsaw University of Technology include modeling of components of integrated circuits and defect simulation. The results obtained so far include FIESTA software system for evaluation of probabilities of logic faults in digital CMOS Ics with application to test generation.
- [Pro61] **Grant for searching partners for a project on photovoltaic systems in Poland submitted to 5FP**, (Poszukiwanie partnerów do aplikacji składanej do 5 PR dotyczącej zastosowania systemów fotowoltaicznych w Polsce), Program PHARE. PL9611/99/02-02.146/459, project leader: Stanisław Pietruszko, March 1999 - September 1999
 Preparation and submission of the project Handbook for Revitalisation of Post-war Quarters.
- [Pro62] **Modelling of technological processes in microelectronics** (Modelowanie procesów technologicznych w mikroelektronice), Byelorussia State University of Informatics and Radioelectronics, Minsk, Byelorussia, project leader: Wiesław Kuźmicz, 1999
 The goal of the project is to develop new mathematical techniques and algorithms for simulation of manufacturing processes in microelectronics, particularly for manufacturing of CMOS integrated circuits, and for modeling of components of these circuits. This project differs from other works in that it treats statistical process and device simulation as a tool for integrated circuit design, not process engineering. The results of the project include application of the RSM methodology to statistical process simulation, development of new algorithms for simulation of specific process steps in manufacturing of submicron VLSI integrated circuits and applications to circuit design.

- [Pro64] **Investigation of bulk and waveguide dielectric structures activated by rare-earth ions for upconversion lasers**, (Badania kryształów domieszkowanych jonami ziem rzadkich dla zastosowań w laserach z konwersją wzbudzenia), Laboratoire de Physico-Chimie des Matériaux Luminescents, Université Claude Bernard Lyon 1, Polonium 0475 1/1999 CNRS, PW-NN/WZ/189/030/98, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Michał Malinowski, co-workers: Adam Wnuk, Marcin Kaczkan, Ryszard Piramidowicz, 1999 - 2000
 In this project various rare earth doped crystals and dielectric waveguides are investigated theoretically and experimentally for their potential use in upconversion lasers, that is devices producing radiation at wavelength shorter than this of the excitation source.
- [Pro65] **Measurements of Superconducting and Dielectric Materials at Microwave Frequencies and Cryogenic Temperatures.** (Pomiary nadprzewodzących i dielektrycznych właściwości materiałów w paśmie czystości mikrofalowych i temperaturach kryogenicznych), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics and NIST USA, project leader: Jerzy Krupka, co-worker: Zbigniew Rudkowski, financial support: M. Skłodowska - Curie Fund II (Fundusz polsko - amerykańskiej Fundacji im. M. Skłodowskiej - Curie), January 1999-December 2001
 The objective of this project is to develop new techniques for measurements of electromagnetic properties of dielectric and superconducting materials at cryogenic temperatures and microwave frequencies. Specific goals of the project are as follows:
 1) Measurements of thin dielectric films using extremely high Q whispering gallery dielectric resonator made of single crystal YAG or sapphire. We expect that using whispering gallery mode resonator it will be possible to measure electromagnetic properties of very low loss dielectric thin films deposited on its surface.
 2) Measurements of the surface impedance of thin superconducting films.
 3) Investigations few resonant techniques for measurements of the complex permittivity of thick and thin film ferroelectrics with and without electric bias. Split dielectric resonator and split re-entrant cavity techniques will be the methods of our investigations at room temperatures and split post sapphire resonator fixture operating at cryogenic temperatures. The measurement programs proposed in this project will be directed at future commercial applications of dielectric and superconducting materials for both the Polish and American electronic industries. The applied research aspects of this work will be the development of new, accurate measurement methods of materials, that can be used and properly qualified for total measurement uncertainties, as commercial standards.
- [Pro66] **Metastability in Amorphous Silicon** (Metastabilność Si krzemie amorficznym), (MEN/DOE-98-345) from U.S. Department of Energy and Polish Ministry of National Education in cooperation with the National Renewable Energy Laboratory, Golden, CO, USA (Maria Skłodowska-Curie Joint Fund II), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Stanisław Pietruszko, 1999 - 2001
 This project is directed at understanding the basic phenomena that limit the performance and reliability of thin-film amorphous solar cells. It is addressing a key fundamental research problem involving the degradation behavior of amorphous silicon. Investigation of the thermally and charge-induced metastability in unhydrogenated and hydrogenated undoped and doped amorphous silicon.
- [Pro67] **Nanocrystalline dielectric layers for SiC electronic devices** (Nanokrystaliczne warstwy dielektryczne dla przyrządów elektronicznych na SiC), Industrial Microelectronics Center IMC/ACREO, Kista, Sweden, project leader: Jan Szmidt, co-workers: Romuald B. Beck, Andrzej Jakubowski, Aleksander Werbowy, 1999 - 2000
 Main goal of the cooperation is to investigate applicability of nanocrystalline and amorphous layers obtained using plasma methods for protection, passivation and dielectric insulation of SiC devices. Project contains characterization of the important properties of deposited layers (structural, mechanical, electronic and optical) with the main objective of establishing technology enabling the utilisation of the named layers in SiC electronic devices.
 Plasma layers will be deposited at WUT on test devices and structures supplied by IMC. Characterization and evaluation will be done jointly and results will be published.

5. DEGREES AWARDED

5.1. D.Sc. Degrees

- [DSc1] Andrzej Pfitzner, **Modelling of the Semiconductor Devices for Statistical Simulation of the VLSI Circuits** (Modelowanie elementów półprzewodnikowych dla statystycznej symulacji układów scalonych VLSI), supervisor Alfred Świt, 13 April 1999.

5.2. Ph.D. Degrees

- [PhD1] Bartłomiej Nowak, **Characterization of Interface States and Other Electrophysical Parameters of MOS and MOS SOI transistors Using Charge pumping** (Charakteryzacja stanów powierzchniowych innych właściwości elektrofizycznych tranzystorów MOS i MOS SOI metodą pompowania ładunku), supervisor Andrzej Jakubowski, 14 December 1999.
- [PhD2] Mohamed Hasan Badri, **Modelling of current- voltage characteristics of Metal - Oxide-Semiconductor Silicon - On - Insulator MOS/ SOI Tunnel diode** (Modelowanie charakterystyk prądowo - napięciowych diody tunelowej Metal Tlenek Półprzewodnik Krzem - Na- Izolatorze MOS/SOI), supervisor: Bogdan Majkusiak, 22 June 1999.
- [PhD3] Aleksander Werbowy, **Films of Nanocrystalline Cubic Boron Nitride for Electronics** (Warstwy nanokrystalicznego kubicznego azotku boru dla potrzeb elektroniki), supervisor: Jan Szmidt, 28 September 1999.

5.3. M.Sc. Degrees

- [MSc1] Cezary Cholewiński, **Optymalizacja warunków pracy jonowego lasera Ar-Kr**, advisor Jerzy Kńsik, fairly good
- [MSc2] Tomasz Pietrzak, **Badanie warunków generacji w laserze jonowym He-Zn**, advisor Tadeusz Adamowicz, good
- [MSc3] Rafał Podskarbi, **System zdalnej akwizycji obrazu: Przesłanie w czasie rzeczywistym sekwencji obrazów standardu MPEG w sieciach komputerowych**, advisor Hanna Górkiewicz Galwas, fairly good
- [MSc4] Wojciech Kijas, **Badania chemoczułości warstw cermetowych pod kątem ich zastosowania w grubowarstwowych czujnikach gazu**, advisor Zbigniew Szczepański, very good
- [MSc5] Dariusz Obrębki, **Optymalizacja kodu VHDL pod kątem szybkości symulacji syntezowalności na przykładzie modelu sterownika I2C BUS**, advisor Elżbieta Piwowarska, excellent
- [MSc6] Tomasz Kamaszewski, **Statystyczna symulacja kontrolerów logiki rozmyłej**, advisor Adam Wojtasik, excellent
- [MSc7] Grzegorz Piotr Olejniczak, **Mikrofalowe wzmacniacze światłowodowych fotoodbiorników telekomunikacyjnych**, advisor Bogdan Galwas, good
- [MSc8] Tomasz Luniewski, **Światłowodowy czujnik temperaturowy**, advisor Jerzy Kruszewski, pass
- [MSc9] Rafał Zbieski, **Właściwości elektrofizyczne heterostruktur na podłożu GaAs**, advisor Jan Szmidt, fairly good
- [MSc10] Marcin Adach, **Szybkościomierz światłowodowy**, advisor Maria Bełłowska, fairly good
- [MSc11] Konrad Habit, **Charakteryzacja elektryczna tranzystora GAA**, advisor Tomasz Janik, very good
- [MSc12] Paweł Magdoń, **Rozmieszczanie komórek standardowych w procesie projektowania układów scalonych VLSI**, advisor Adam Wojtasik, good
- [MSc13] Arkadiusz Włodarczyk, **Magnesowanie próbek w automatycznych systemach do pomiarów materiałów magnetycznie twardych**, advisor Janusz Rogowski, very good
- [MSc14] Ryszard Szymon Rodziewicz, **Problemy rozkładu temperatur na płycie drukowanej w procesie lutowania rozpliwowego**, advisor Ryszard Kisiel, pass
- [MSc15] Maciej Olejnicki, **Badanie wpływu pola magnetycznego magnesów trwałych na parametry lasera argonowego**, advisor Jerzy Kńsik, good
- [MSc16] Adam Lutomirski, **Fotodiody PIN w układzie mieszacza mikrofalowego**, advisor Jerzy Piotrowski, pass
- [MSc17] Maung Than Htun Aung, **Modeling and characterization of test structure the need for diagnosis technological circuits fabrication line**, advisor Jan Szmidt, good
- [MSc18] Mariusz Świetlik, **Zastosowanie klejów elektrycznie przewodzących do montażu układów elektronicznych w motoryzacji**, advisor Ryszard Kisiel, very good
- [MSc19] Adam Gałuszka, **Ocena możliwości zastosowania stopu SnB do wykonywania połączeń lutowanych na płytkach drukowanych**, advisor Ryszard Kisiel, very good
- [MSc20] Janusz Borecki, **Zastosowanie lutów bezołowiowych do montażu układów elektronicznych w motoryzacji**, advisor, Ryszard Kisiel, very good
- [MSc21] Arkadiusz Tokasz, **Badanie jonowego lasera He-Au generującego w obszarze ultrafioletu**, advisor Tadeusz Adamowicz, very good
- [MSc22] Adam Jarosz, **Modelowanie i pomiar parametrów tranzystorów MOS z kanałami o złożonych kształtach**, advisor Elżbieta Piwowarska, excellent
- [MSc23] Marcin Dziok, **Zagadnienie optymalizacji mocy w laserrach DFB z jednoczesną modulacją współczynnika załam. i współczynnika str.**, advisor Paweł Szczepański, good
- [MSc24] Marek Dzwonnik, **Uniwersalny moduł interfejsu użytkownika do mikroprocesowego miernika szumów**, advisor Wojciech Wiatr, good

[MSc25] Grzegorz Janczyk, **Określenie rezystancji obszarów rezystywnych o zaburzonych kształtach**, advisor Wiesław Kuźmicz, excellent

5.4. B.Sc. Degrees

- [BSc1] Zofia Orzechowska, **Badanie parametrów tranzystora nośników w cienkich warstwach krzemu amorficznego**, advisor Stanisław Pietruszko, good
- [BSc2] Sławomir Żarzyński, **Mikrofalowy modulator amplitudy z tranzystorem dwubramkowym**, advisor Bogdan Galwas, good
- [BSc3] Marcin Madej, **Nadajnik AM na czystotliwość 800 MHz**, advisor Bogdan Galwas, good
- [BSc4] Tomasz Ziemiński, **Akwizycja danych z przyrządów pomiarowych przy użyciu magistrali Hp-IB**, advisor Andrzej Wałkanis, good
- [BSc5] Tomasz Stawowy, **Opracowanie technologii dołączania krzemowych struktur czujników pomiarowych do podłoży krzemowych**, advisor Zbigniew Szczepański, good
- [BSc6] Grzegorz Czarnota, **Technologia wykonywania kontaktów podwyższonych dla technologii Flip - Chip**, advisor Zbigniew Szczepański, good
- [BSc7] Krzysztof Tomaszewicz, **Badanie właściwości użytkowych klejów przewodzących**, advisor Ryszard Kisiel, good
- [BSc8] Mariusz Cegiełka, **Projekt zestawu Komórek standardowych implementujących założone funkcje logiczne i ich optymalizacja pod kątem szybkości**, advisor Andrzej Wilgus, good
- [BSc9] Jacek Biżkowski, **Implementacja interfejsu IEC-625 w submikronowej technice CMOS**, advisor Mirosław Grygolec, pass
- [BSc10] Norbert Ługowski, **Model VHDL układu kompresji i dekompresji danych**, advisor Elżbieta Piwowarska, good
- [BSc11] Janusz Zabłocki, **Model VHDL układu sterującego pomiarem temperatury, przewodności i dyfuzyjności cieplnej**, advisor Elżbieta Piwowarska, fairly good
- [BSc12] Rafał Niewczas, **Zbadanie i wykonanie refraktometrycznego czujnika światłowodowego mierzącego poziom lustra wody**, advisor Maria Bebłowska, good
- [BSc13] Marcin Wiźniewski, **Oprogramowanie eksperymentów pomiarowych przy użyciu magistrali HPIB**, advisor Mirosław Grygolec, good
- [BSc14] Mariusz Nowicki, **Technologia połączeń na podłożach polimerowych**, advisor Zbigniew Szczepański, fairly good
- [BSc15] Paweł Wrzosek, **Zasilanie włókien optycznych**, advisor Michał Borecki, good
- [BSc16] Robert Szarejko, **Badanie parametrów lasera argonowego - opracowanie laboratoryjnego ćwiczenia studenckiego**, advisor Jerzy Kżsik, good
- [BSc17] Grzegorz Chlebowski, **Opracowanie systemu fotowoltaicznego do zasilania obiektu wolnostojącego**, advisor Stanisław Pietruszko, good
- [BSc18] Konrad Badowski, **Opracowanie oprogramowania do symulacji systemów makroelektronicznych do konwersji energii**, advisor Stanisław Pietruszko, very good
- [BSc19] Przemysław Robert Dmochowski, **Tranzystorowy wzmacniacz szerokopasmowy**, advisor Jerzy Piotrowski, good

6. PUBLICATIONS

6.1. Scientific and Technical Books

- [Pub1] M.H. Badri, **Modelling of current- voltage characteristics of Metal - Oxide-Semiconductor Silicon - On - Insulator MOS/ SOI Tunnel diode** (Modelowanie charakterystyk prądowo - napięciowych diody tunelowej Metal Tlenek Półprzewodnik Krzem - Na- Izolatorze MOS/SOI), Oficyna Wydawnicza PW, Warsaw 1999
- [Pub2] K. Braclawski, J. Maciak, K. Sadowski, **Laboratorium przyrządów półprzewodnikowych – diody półprzewodnikowe**, Oficyna Wydawnicza PW, Warsaw 1999
- [Pub3] R. Kisiel, A. Bajera, **Podstawy konstruowania urządzeń elektronicznych**, Oficyna Wydawnicza PW, Warsaw 1999, pages 204
- [Pub4] J. Krupka and R. Geyer, chapter 3915/IM: **Loss angle measurement**, vol.11, Wiley Encyclopedia of Electrical and Electronics Engineering, John Wiley & Sons, Inc., Publishers, 1999, pp. 606-619
- [Pub5] J. Krupka, R. Morawski, L. Opalski, **Wstęp do metod numerycznych**, Oficyna Wydawnicza PW, Warsaw 1999, pages 179
- [Pub6] A. Kujawski, P. Szczepanski, **Fundamentals of lasers**, (Lasery, podstawy fizyczne), Oficyna Wydawnicza PW, Warsaw 1999, pages 177
- [Pub7] W. Kuńmich, **Perspektywy i główne kierunki badan i rozwoju mikroelektroniki w ciagu najbliższych 5-10 lat**, chapter in Polska 2000 Plus, Perspektywy Awangardowych Dziedin Nauki i Technologii do Roku 2000, Warsaw 1999, pp. 48-77
- [Pub8] B. Nowak, **Characterization of Interfaace States and Other Electrophysical Parameters of MOS and MOS SOI transistors Using Charge pumping** (Charakteryzacja stanów powierzchniowych innych właściwości elektrofizycznych tranzystorów MOS i MOS SOI metodą pompowania ładunku), Oficyna Wydawnicza PW, Warsaw 1999
- [Pub9] A. Pfitzner, **Modelling of the Semiconductor Devices for Statistical Simulation of the VLSI Circuits** (Modelowanie elementów półprzewodnikowych dla statystycznej symulacji układów scalonych VLSI), Oficyna Wydawnicza PW, Prace Naukowe seria Elektronika Z 120, Warsaw 1999, pages 191
- [Pub10] A. Werbowy, **Films of Nanocrystalline Cubic Borou Nitride for Electronics** (Warstwy nanokrystalicznego kubicznego azotku boru dla potrzeb elektroniki), Oficyna Wydawnicza PW, Warsaw 1999
- [Pub11] J. Wońnicki, **Model zarządzania publiczną instytucją akademicką**, Instytut Spraw Publicznych, Warsaw 1999, pages 400

6.2. Scientific and Technical Papers published in Journals Included in the ISI¹ Database

- [Pub12] M. Badri, B. Majkusiak, **Theory of the MOS/SOI tunnel Diode**, Microelectronic Engineering, vol.48, pp.375-378, 1999
- [Pub13] T. Brońek, E.C. Szyper, C.R. Viswanatan, **Erratum to Polarity dependence of cumulative properties of charge-to-breakdown in very thin gate oxides**, Solid State Electronics, vol.43, pp. 693-696, 1999
- [Pub14] J. Chramiec, J. K. Piotrowski, **Universal formula for frequency-dependent coaxial open-end effect**, Electronics Letters, vol.35, no.17, pp. 1474-1475, 1999
- [Pub15] J. G. Hartnett, M. E. Tobar, A. G. Mann, E. N. Ivanov J. Krupka, and R. Geyer, **Frequency-temperature compensation in Ti3+ and Ti4+ doped sapphire whispering gallery mode resonators**, IEEE Trans. on Ultrasonics, Ferroelectrics and Frequency Control, vol.45, No.3, pp. 993-1000, July 1999
- [Pub16] M.F. Joubert, S. Guy, M. Malinowski, R. Piramidowicz, A.Wnuk, G. Chadeyron, **Photon avalanche upconversion in YAlO₃:Ho³⁺ crystals**, Radiation Effects & Defects in Solids, vol.150, pp. 79-83, 1999
- [Pub17] S. K. Kim, S. I. Cho, Y. J. Choi , K. S. Cho, J. Jang and S.M. Pietruszko, **Coplanar Amorphous Silicon Thin Film Transistor Fabricated by Inductively-Coupled Plasma CVD**, Thin Solid Films, vol.337, pp. 200-202, 1999
- [Pub18] M. Kostana, S.M. Pietruszko and J. Jang, **Stability of LPCVD Amorphous Silicon**, Thin Solid Films, vol.337, pp. 78-81, 1999
- [Pub19] J. Krupka, K. Derzakowski, M.E. Tobar, J. Hartnett, and R.G. Geyer, **Complex permittivity of some ultralow loss dielectric crystals at cryogenic temperatures**, Measurement Science and Technology, vol.10, pp. 387-392, Oct. 1999
- [Pub20] J. Krupka, K. Derzakowski, A. Abramowicz, M.E. Tobar and R. G. Geyer, **Whispering Gallery Modes for Complex Permittivity Measurements of Ultra-Low Loss Dielectric Materials**, IEEE Trans. on Microwave Theory Tech, vol. MTT-47, pp. 752-759, June 1999
- [Pub21] J. Krupka, S. A. Gabelich, K. Derzakowski, and B. M. Pierce, **Comparison of split-post dielectric resonator and ferrite disk resonator techniques for microwave permittivity measurements of polycrystalline yttrium iron garnet**, Measurement Science and Technology, vol. 10, pp. 1004–1008, November 1999
- [Pub22] M. Malinowski, R. Piramidowicz, Z. Frukacz, G. Chadeyron, R. Mahiou, M.F. Joubert, **Spectroscopy and upconversion in YAlO₃:Ho³⁺**, Optical Materials, vol.12, pp. 409-423, 1999
- [Pub23] M. Niewiński, P. Szwemin, A. Calcatelli, M. Bergoglio, **Conductance Evaluation of the Orifice of the New CNR-IMGC Dynamic Expander**, Metrologia, vol.36, no.6, pp. 555-559, 1999
- [Pub24] W. A. Pleskacz, C. H. Ouyang, W. Mały, **A DRC Based Algorithm for Extraction of Critical Areas for Opens in Large VLSI Circuits**, IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, vol.18, no.2, pp. 151-162, February 1999

¹ Institute for Scientific Information (Philadelphia, USA)

- [Pub25] R. Piramidowicz, I. Pracka, W. Woliński, M. Malinowski, **Blue-green emission of Pr³⁺ ions in LiNbO₃**, J.Phys.Condens. Matter., vol.11, pp. 1-10, 1999
- [Pub26] J. Szmidi, **Electronic properties of nanocrystalline layers of wide-band-gap materials**, Chaos, Solitons & Fractals, vol.10, no.12, pp. 2099-2152, 1999
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- [Pub147] R. Sitnik, M. Kujawińska, M. Pawłowski, J. Wońnicki, **3D objects opto-numerical acquisition methods for CAD/CAM and computer graphics systems**, vol.3744, pp. 146-153, Proceedings of SPIE, International Conference Interferometry'99, Pułtusk, 1999
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- [Pub165] J. Wońnicki, S. Berczyński, **Ten years of evolving strategies of engineering education in Poland**, pp. 137-142, Proceedings of the International Conference on "Internationalisation of Education and Scientific Researchers in XXI Century, Role of Technical Universities" St. Petersburg, 1999, Russia
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6.5. Other Publications

- [Pub167] M. Borecki, J. Kruszewski, M. Bełłowska, **System czujników światłowodowych do monitorowania poziomu wody**, Wyniki prac prowadzonych w programie priorytetowym Inżynieria Fotoniczna w latach 1998-1999, 1999, pp. 1-15
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- [Pub169] J. Krupka, M. Tobar, R. Geyer, and C. Weil, **Measurement techniques of extremely low loss dielectrics at microwave frequencies**, The Dielectric Society 30th Annual Conference, Canterbury, 12-14 April 1999, 1 page summary
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- [Pub174] C. Weil, J. Baker-Jarvis, B. Riddle, M. Janezic, J. Krupka, **Measurement issues involving accurate RF characterization of printed wiring boards**, The Dielectric Society 30th Annual Conference, Canterbury, 12-14 April, 1999 1 page summary
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7. RESEARCH REPORTS

- [Rep1] T.M. Adamowicz, **Researches On Metal Ion Lasers For Ultraviolet Laser Generation** (Badania laserów jonowych na parach metali dla generacji w obszarze nadfioletu)
- [Rep2] M. Baszun, **Analysis of Delay Lines with Interdigital Transducers for Liquid Sensors Applications** (Analiza linii opóźniających z przetwornikami międzypalczastymi do zastosowań czujnikowych w cieczach),
- [Rep3] R.B. Beck, **Formation Of SOI (Silicon-On-Insulator) Structures On Silicon Wafers With An Epitaxial Layer Deposited On Porous Silicon (FIPOS)** (Wytwarzanie struktur SOI (krzem na izolatorze) na płytkach krzemowych z warstw epitaksjalnych osadzonych na warstwie porowatego krzemu (FIPOS))
- [Rep4] K. Domański, **Applications of porous silicon for fabrication of micromechanical sensors silicon components** (Zastosowania porowatego krzemu do wytwarzania krzemowych elementów czujników mikromechanicznych)
- [Rep5] B. Galwas, **Modulation And Controlling Of Microwave Circuits By Means Of Optical Radiation** (Badania metod modulacji i sterowania układami mikrofalowymi z wykorzystaniem promieniowania optycznego)
- [Rep6] H. Górkiewicz-Galwas, **Analysis of tree structures in medical images** (Analiza struktur drzewiastych w obrazach medycznych)
- [Rep7] H. Górkiewicz-Galwas, **Texture Analysis System**, (System analizy tekstur)
- [Rep8] A. Jakubowski, **Methods for the Characterisation of SOI Materials and Devices** (Metody charakteryzacji materiałów i przyrządów SOI).
- [Rep9] J. Krupka, **Measurements of Superconducting and Dielectric Materials at Microwave Frequencies and Cryogenic Temperatures**
- [Rep10] J. Krupka, **The Elaboration Of Design Methods And Realisation Of New Microwave Filters With Dielectric Resonators For Telecommunication And Cellular Telephony** (Opracowanie metod projektowania i wykonanie nowych typów filtrów mikrofalowych z rezonatorami dielektrycznymi dla telekomunikacji i telefonii komórkowej)
- [Rep11] J. Laskowski, **Designing And Verification Method Of The Reference Structure Of Submicrometer MOS Transistor For Analytical Models** (Metoda projektowania i weryfikacji wzorcowej struktury submikrometrowego tranzystora MOS dla konstruowania fizycznych modeli elektrycznych.)
- [Rep12] A. Lejman, **A Verification Method for Analytical Models of Doping in Manufacturing of VLSI** (Metoda weryfikacji analitycznej modeli domieszkowania dla technologii wytwarzania submikrometrowych układów VLSI)
- [Rep13] M. Malinowski, **Studies On Laser-Diode Excitation And Construction Of Planar Waveguide Nd:YAG/YAG Lasers** (Opracowanie metod wzbudzenia, podzespołów i konstrukcji falowodowych laserów cienkowarstwowych Nd:YAG/YAG pobudzanych diodami laserowymi)
- [Rep14] P. Szczepański, **The Effect Of Gaussian Variable Reflectivity Mirror On Parameters Of Waveguide Lasers** (Analiza wpływu zastosowania zwierciadeł gaussowskich na parametry laserów objętościowych i falowodowych)
- [Rep15] P. Szwemin, **Vacuum Controller for the pressure range 10^5 - 10^{10} Pa** (Opracowanie próżniomierza jonizacyjnego na zakres 10^{10} - 100000 Pa z mikroprocesorowym układem kontrolnym)
- [Rep16] W. Woliński, **Elaboration Of Fibre Optic Amplifiers At The Range 1060nm For Laser Range-Finder And At 1530nm Pumped By Laser Diodes** (Opracowanie wzmacniaczy włóknowych X. na zakres 1060 nm dla dalmierza laserowego i na 1530 nm pobudzanych diodami laserowymi)
- [Rep17] J. Woźnicki, **Microscopic image analysis and recognition system** (System analizy i rozpoznawania cyfrowych obrazów mikroskopowych)

8. PATENTS

- [Pat1] J. B. Galwas, B. Jakubowski, A. Kulpa, J. Piotrowski, **System for contents monitoring of selected components of material** (Urządzenie do monitorowania zawartości wybranych składników materiału), Patent no: PL 176419 B1

9. CONFERENCES, SEMINARS AND MEETINGS

9.1. International Conferences

- [Con1] **2nd International Fair and Expo, New Technologies, Innovations and Industrial Design - INTERTECHNOLOGY'99**, Łódź, Poland, June 1999
co-organizer: J. Szmidt
- [Con2] **3rd CCM Interinational Conference** Torino, Italy, 3-7 May 1999
speaker: P. Szwemin,
reporters: M. Niewiżski, K. Szymański
- [Con3] **3rd International Symposium on Microelectronic Technolgies and Microsystems**, Koszyce, Slovakia, 3-5 June 1999
speaker: Z. Szczepański
- [Con4] **3rd International Winter Workshop on Spectroskopy and Structure of RE Systems**, Szklarska Poreba, 26 April - 1 May 1999
speaker: M. Malinowski,
reporters: M. Malinowski, M. Kaczkan, R. Piramidowicz
- [Con5] **5th Intern. Conference on The Experience of Designing and Application of CAD System in Microelectronics CADSM'99**, Lwow, Ukraine, 1-6 February 1999
speaker: W. Pleskacz
reporters: A. Jakubowski, W. Pleskacz
- [Con6] **8th European Conference on Power Electronics and Applications EPE'99**, Lausanne, Swiss, 7-9 September 1999
reporter: J. Szmidt
- [Con7] **8th International Biannual Conference on Solar Energy in High Lattitudes, Conference North Sun'99**, Edmonton, Canada, 10-14 August 1999
speaker: S.M. Pietruszko
- [Con8] **9th CIMTEC-World Ceramic Congress. Ceramics: Getting into the 2000's**, Florence, Italy, 14-10 June 1999
reporters: A. Werbowy, J. Szmidt
- [Con9] **9th International Symposium on Silicon-on –Insulator Technology and Devices**, Seattle, USA, May 1999
speaker: L. Łukasiak
- [Con10] **10th European Conference on Diamond, Diamond-like Materials, Nitrides and Silicon Carbide**, Prague, Czech, 12-17 September 1999
reporter: A. Werbowy
- [Con11] **10th Internatinal Workshop on the Physics of Semiconductor Devices IWSPD'99**, New Delhi, India, 14-18 Dec. 1999
speakers: A. Jakubowski, L. Łukasiak, S.M. Pietruszko,
co-organizer: A. Jakubowski
- [Con12] **10th International Conference "MICROCOLL"**, Budapest, Hungary, 21-24 March 1999
reporters: J. Dawidczyk, J. Krupka, Z. R. Szczepaniak,
- [Con13] **12th International Colloquium on PLASMA PROCESSES CIP'99**, Antibes-Juan-les-Pins, France, 6-10 June 1999
reporter: J. Szmidt
- [Con14] **13th International Conference IC-SPETO**, Gliwice-Ustroż, Poland, 20-23 May 1999
speaker: B. A. Galwas
- [Con15] **18th Congress of the International Commission for Optics (ICOXVIII)**, San Francisco, USA, 2-6 August 1999
reporter: P. Szczepański
- [Con16] **18th International Conference on Amorphous and Microcrystalline Semiconductors**, Snowbird, USA, 23-27 August 1999
reporter: S.M. Pietruszko
- [Con17] **1999 Symposium on High Performance Electron Devices for Microwave & Optoelectronic Applications "EDMO"**, London, UK, 22-23 November 1999
reporters: J. Dawidczyk, Z. R. Szczepaniak,
- [Con18] **1999 Symposium on VLSI Technology , Digest of Technical Papers**, Kyoto, Japan, 14-16 June 1999
speaker: M. Jurczak
- [Con19] **22nd Conference of IMAPS Poland**, Zakopane, Poland, 1-3 October 1999
speakers: A. Jakubowski, L. Łukasiak
- [Con20] **22nd Interinational Spring Seminar on Electronics Technology ISSE'99**, Drezno, Germany, 17-21 May 1999
speaker: R. Kisiel
- [Con21] **29th European Solid State Device Research Conf., ESSDERC'99**, Leuven, Belgium, 13-15 September 1999
speaker: M. Jurczak
- [Con22] **29th European Microwave Conference**, Munich, Germany, 4-8 October 1999
reporter: J. Krupka
- [Con23] **35th Interinational Conference on Microelectronics, Devices and Materials MIDEM'99**, Słowenia, 12-17 October 1999
speaker: R. Kisiel
- [Con24] **CLEO/Europe-EQEC Focus Meeting – Novel Lasers and Devices Topical Meeting**, Munich, Germany, 14-16 June 1999
reporter: P. Szczepański
- [Con25] **Conference to Launch 5th Framework Programme of EC on RTD**, Essen, Germany, 24-26 February 1999
audience: S.M. Pietruszko

- [Con26] **European MRS Conference on Photovoltaics**, Cracov, Poland, 25-27 October 1999
reporters: S. M. Pietruszko, M. Kostana
- [Con27] **Exploring The Information Society IST'99**, Finlandia, 20-24 November 1999
audience: W. Kuźmicz
- [Con28] **ICEAA Conference**, Torino, Italy, 13-17 September 1999
reporter: J. Krupka
- [Con29] **IEA PVPS Task 1 Experts Meeting**, Kyoto, Japan, 27-29 September 1999
speaker and co-organizer: S.M. Pietruszko
- [Con30] **IEA PVPS Task 7 Experts Meeting**, Linz, Austria, 14-16 April 1999
speaker and co-organizer: S.M. Pietruszko
- [Con31] **International Conference on Internationalization of Education and Scientific Researches in XXI Century - Role of Technical Universities**, St. Petersburg, Russia, 23-26 June 1999
speaker: J. Woźnicki
- [Con32] **International Conference, SPIE - Interferometry'99: Technics and Technology**, Pułtusk, Poland, 20-23 September 1999
reporter: J. Woźnicki
- [Con33] **International Electron Devices Meeting, IEDM'99**, Washington, USA, 5-8 December 1999
speaker: M. Jurczak
- [Con34] **International Symposium on Defect and Fault Tolerance in VLSI Systems – DFT'99**, Albuquerque, New Mexico, USA, 1-3 November 1999
reporter: W. Pleskacz
- [Con35] **International Workshop on New Approaches to High-Tech: Nondestructive Testing and Computer Simulations in Science and Engineering**, St. Petersburg, Russia, 7-11 June 1999
speaker: W. Kuźmicz
- [Con36] **ISES Solar World Congress**, Jerozolima, Izrael, 04-11 July 1999
speaker: S.M. Pietruszko
- [Con37] **MIXDEX'99**, Cracow, Poland, 17-19 June 1999
co-organizers: W. Kuźmicz, A. Pfitzner
speakers: E. Piwowarska, W. Pleskacz, A. Lejman, A. Jarosz
- [Con38] **Photovoltaics Integration Concepts Workshop**, Lausanne, Swiss, 11-12 February 1999
speaker: S.M. Pietruszko
- [Con39] **Proceedings of the 11th International Conference on Photovoltaic Science and Engineering**, Sapporo, Japan, 21-24 September 1999
reporter: S.M. Pietruszko
- [Con40] **Spindulouotes IR Medziagos Saveika – Konferencijos pranesimu medziaga**, Kaunas, 1999
reporter: T. Łozowski, R.B. Beck
- [Con41] **The 2-nd EAA International Symposium on Hydroacoustics**, Jurata, Poland, 24-27 May 1999,
reporter: M. Baszun
- [Con42] **Workshop on PV Added Values**, Sapporo, Japan, 25 September 1999
audience: S.M. Pietruszko
- [Con43] **World Multiconference on SYSTEMICS, CYBERNETICS AND INFORMATICS**, Orlando, Floryda, USA, 31 July – 4 August 1999
reporter: M. Baszun
- [Con44] **World Sustainable Energy Conference Sustain'99**, Amsterdam, Holland, 22-28 May 1999
audience: S.M. Pietruszko
- [Con45] **XXIII Conf. of the Intern. Microelectronics and Packaging Society Poland Chapter – IMAPS'99**, Koszalin, Kołobrzeg, Poland, 21-23 September 1999
speakers: A. Jakubowski, L. Łukasiak
- [Con46] **XXIII Conference of IMAPS-POLAND**, Kołobrzeg, Poland, 20-23 September 1999
reporters: R. Kisiel, Z. Szczepański, M. Jakubowska, P. Gonciara,
co-organizer: R. Kisiel
- [Con47] **XXIV International Conf. on Phenomena in Ionized Gases**, Warsaw, Poland, 11-16 July 1999
reporters: W. Kwazniewski, T.M. Adamowicz

9.2. Local Conferences

- [Con48] **Akustyka Strukturalna, Metody falowe w inżynierii Biomedycznej**, Zakopane, 18-24 April 1999
reporter: M. Baszun
- [Con49] **“Odnawialne źródła energii a bilans energetyczny kraju” -posiedzenie Komisji Ochrony środowiska Senatu RP**, Warsaw, 12 May 1999
speaker and co-organizer: S. M. Pietruszko
- [Con50] **II Konferencja Ochrony środowiska w Energetyce i Przemysle**, Połaniec, 21-23.04. 1999
reporters: B. Galwas, J. Piotrowski, J. Skulski
- [Con51] **III Ogólnopolska Konferencja Kształcenie Ustawiczne Inżynierów i Menedżerów**, Kielce, 25-27 October 1999
reporter: B. Galwas

- [Con52] **IV Forum Energetyczne'99**, Jadwisin k/Serocka, 01-03 December 1999
speaker and co-organizer: S. M. Pietruszko
- [Con53] **Konferencja Bezpieczeństwo i niezawodność SKONBiN'99**, Zakopane,
reporter: J. Pogorzelska
- [Con54] **Konferencja Polskiego Komitetu ds. UNESCO**, Warsaw, April 1999
speaker: J. Woźnicki
- [Con55] **V Krajowa Konferencja Techniki PróŹni**, Borki, 9-11 June 1999
speakers: P. Szwemin, M. NiewiŹski
reporters: M. NiewiŹski, K. SzymaŹski
co-organizer: P. Szwemin
- [Con56] **Konferencja Rektorów Akademickich Szkół Polskich, Posiedzenie Prezydium**, Rogów, 9-10 October 1999
chairman: J. Woźnicki
- [Con57] **Konferencja Rektorów Polskich Uczelni Technicznych**, Gdynia, 28-30 January 1999
chairman: J. Woźnicki
- [Con58] **Konferencja Rektorów Polskich Uczelni Technicznych**, Szczecin, 17-19 June 1999
chairman: J. Woźnicki
- [Con59] **Konferencja Rektorów Uczelni Warszawskich**, Warsaw, 8 October 1999, 29 November 1999, 21 December 1999
chairman: J. Woźnicki
- [Con60] **VI Ogólnopolskie Seminarium "TECHNIKI JONOWE"**, Szklarska Porzba, 3-5 March 1999
reporters: J. Szmida, R.B. Beck
- [Con61] **VI Sympozjum Techniki Laserowej**, Szczecin-ŹwinoujŹcie, 27 September -1 October 1999
speakers: M. Malinowski, P. SzczepaŹski, W. WoliŹski
reporters: T.M. Adamowicz, M. Borecki, K. DziŹciolowski, J. KŹsik, T. Kossek, M. Malinowski, A. Mossakowska-WyszyŹska, P. SzczepaŹski, A. Tysza-Zawadzka, P. Warda, P. WitoŹski, W. WoliŹski
co-organizers: S. Jonak, W. WoliŹski,
audience: M. Kaczkan, W. KwaŹniewski, R. Piramidowicz
- [Con62] **VII Konferencja Źwiatłowodów i ich zastosowanie**, Krasnobród, 14-16 October 1999
reporters: M. Borecki, J. Kruszewski, M. Beblowska
- [Con63] **XXII National Conference on Circuits Theory and Electronic Networks, KKTOiE**, Warsaw-Stare Jabłonki, 20-23 October 1999
reporters: A. Pfitzner, J. Laskowski
co-organizer: W. KuŹmicz

9.3. Schools and Seminars

- [Con64] **3rd International Seminar on Precision and Electronic Technology**, Warsaw, Poland, 22-24 November 1999
reporter: Z. SzczepaŹski
- [Con65] **28-th Winter School on M&Q Acoustics**, UstroŹ, Poland, 22-26 February 1999
speaker: M. Baszun
- [Con66] **9th International Travelling Summer School on Microwaves & Lightwaves**, Roma, Italy, 11-15 July 1999
organizer: B. A. Galwas,
speakers: B. A. Galwas, J. K. Piotrowski, P. SzczepaŹski,
audience: J. Dawidczyk, T. Kossek, Z. Szczepaniak
- [Con67] **Analogue CMOS IC Design Course**, IMiO PW, Warsaw, Poland, 15-18 March 1999,
organizers: W. KuŹmicz, J. Gempel, S. Jeszka,
speaker: W. KuŹmicz:
- [Con68] **Seminar on Solar Electricity from Building Environment**, Stockholm, Sweden, 12-13 April 1999,
speaker: S.M. Pietruszko
- [Con69] **Seminarium "Dom Ekologiczny"**, Warsaw, Poland, 26 March 1999
speaker: S.M. Pietruszko
- [Con70] **XLVI Otwarte Seminarium z Akustyki**, Zakopane, Poland, 14-17 September 1999
speakers: L. KsiŹŹek, M. Baszun