



WARSAW UNIVERSITY OF TECHNOLOGY
FACULTY OF ELECTRONICS AND INFORMATION TECHNOLOGY

INSTITUTE OF RADIOELECTRONICS

ANNUAL REPORT

1996

Warsaw, April 1997

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From the Director

For the first time we are presenting the Annual Report of the Institute of Radioelectronics in English. As in the official reports which had been issued in Polish up to 1995, it gives an overview of our research and teaching activities, but we have felt that our communication strategy has needed revamping to keep pace with everything that is going on in the dynamic world of science, engineering, and education. We need to communicate more effectively, both on a global and individual scale. This means we need to reach more readers. And we need to present well-structured information from which an interested reader can easily extract the relevant data.

What is special about the Institute of Radioelectronics among other institutes within the Faculty? The first thing you notice while looking at the report are the number of, but we would rather like to attract your attention to the diversity of, the research fields investigated by our staff and students. Please note that our 109 of published papers and 67 of projects conducted covers a wide variety of issues from the physics of wave propagation and the mathematics of signal theory to prototype production of radio engineering equipment. We work in the domains of electroacoustics and electromagnetics, nuclear and biomedical engineering, radiocommunications and television, signal processing and monitoring systems.

This diversification of interests allows us to offer multi-facet education to our students. They can develop their own skills and broaden their horizons in a friendly environment. Our idea is not just to respond to the need for electronics engineers on today's job market but to build a curriculum with an educational ideal. We want to combine purpose and coherence, motivation and know-how to meet the needs of young people for education, and not just to train them in one discipline within the field of radioelectronics.

Last but not least, we aim to use our on-site experience and expertise in the many subdomains of electronics to the best advantage of projects in scientific and applied research.

Who are the readers we want to reach? Potential research partners from Polish, European or overseas laboratories. Industrial companies that may be interested in joint application-oriented projects. Past, present and prospective partners in TEMPUS, ERASMUS, COPERNICUS or ESPRIT projects. Past supporters, prospective supporters. Educational institutions sharing our goals and facing similar challenges. Graduates and ex-staff interested in keeping track of developments within the Institute. Prospective students - those who are just about to leave secondary school and those who may be considering participating in our programme of continuing education.

We hope you will enjoy reading this report. We hope you will like the format and style, but we are also open to constructive criticism. What areas should be expanded further? Which should be downplayed? We will appreciate your feedback and we will be glad to answer your questions. We will be pleased, upon request, to send you reprints of our papers and reports.

Warsaw, April 1997

Profesor Józef Modelski, Ph.D., D.Sc.

Contents

1. GENERAL INFORMATION	1
1.1. Mission of the Institute	1
1.2. Board of Directors	1
1.3. Organisation of the Institute	2
1.3.1. Radiocommunications Division	2
1.3.2. Television Division	2
1.3.3. Electroacoustics Division	2
1.3.4. Radio Engineering Devices Division	3
1.3.5. Microwave Engineering Division	3
1.3.6. Piezoelectric Measurement Division	4
1.3.7. Nuclear and Medical Electronics Division	4
2. STAFF	5
2.1. Senior academic staff	5
2.2. Junior academic staff	9
2.3. Technical and administrative staff	9
3. TEACHING ACTIVITIES (academic year 1995/96)	10
3.1. Basic courses	10
3.2. Advanced courses	11
3.3. Special courses	12
3.4. International co-operation	13
4. RESEARCH PROJECTS	13
4.1. Projects granted by the University	13
4.2. Projects granted by the State Committee for Scientific Research (KBN)	18
4.3. Other projects	21
5. DEGREES AWARDED	23
5.1. Ph.D. Degrees	23
5.2. M.Sc. Degrees	23
6. PUBLICATIONS	25
6.1. Scientific and technical books	25
6.2. Scientific and technical papers in journals	25
6.3. Scientific and technical papers in conference proceedings	26
6.4. Textbooks	30
6.5. Other publications	30
7. REPORTS	31
7.1. Research reports	31
8. HOME PATENTS	32
9. CONFERENCES, SEMINARS AND MEETINGS	32
9.1. International conferences	32
9.2. Local conferences	33
9.3. Schools and seminars and meetings	34
10. STATISTICAL DATA	35

This Annual Report summarizes the research activities of the Institute in 1996, as well as the teaching activities of the academic year 1995/96. Corresponding publications concern to the period October 1, 1995 - December 31, 1996.

1. GENERAL INFORMATION

1.1. Mission of the Institute

A distinctive feature of the Institute of Radioelectronics among other institutes of the Faculty is its extremely wide field of scientific and applied research, spanning a variety of issues from the physics of wave propagation and the mathematics of signal theory to the production of radio engineering equipment prototypes.

In the scientific field, the following key research objectives are pursued:

- electromagnetic and acoustic field theory as well as generation and propagation of electromagnetic and acoustic waves,
- signal theory, processing, coding, and transmission, with regard to electronic, electroacoustic and TV image signals,
- physical phenomena in radio engineering, acoustic, nuclear engineering, and medical systems,
- detection and spectrometry of radiation,
- analysis and synthesis of electronic systems,
- measuring methods and systems,
- analysis, measurement and estimation of sound and image distortion.

The Institute's researchers publish over a hundred scientific papers yearly, most of them in reviewed Polish and foreign journals and in international conference proceedings. The scientific accomplishments of several research groups have gained world-wide recognition exemplified by invitations to publish papers in prestigious journals as well as to present the results of their work at high-ranking European and American conferences. This recognition leads to an increasing number of links with foreign research and industrial institutions including Université du Québec a Trois-Rivieres (Canada), ZIBJ Dubna (Russia), Forschungs-Gesellschaft für Informationstechnik GmbH (Germany), and Chalmers University of Technology (Sweden). Joint projects, seminars, and exchange of students and staff ensure state-of-the-art orientation of the Institute's research.

The applied research is mainly concerned with computer aided design of radio engineering equipment, medical diagnostic equipment, and measurement systems including:

- radio communication systems,
- radiolocation antennas,
- television equipment,
- radiomonitoring systems,
- high-efficiency energy sources,
- high-power radio engineering devices,
- equipment for time and frequency services,
- measurement systems involving nuclear engineering for scientific research, industry, and medicine.

Prototypes and short series of the instrumentation are constructed. The applied research is in a large part financed by industrial projects ordered by, in particular, National Radiocommunication Agency PAR, Polish Telecommunications as well as military institutions.

The teaching activity of the Institute of Radioelectronics encompasses undergraduate and postgraduate studies as well as continuing education. At the undergraduate

level, the Institute participates in a two-stage programme of study leading to a Bachelor's or Master's degree in the following areas of concentration:

- Radio Frequency Engineering (profiles: radiocommunications, electroacoustics, television, radiolocations);
- Biomedical Engineering;
- Measuring and Monitoring Systems;
- Computer Engineering.

In 1996, 40 students received their M.Sc. degrees from the Institute. The graduates can find interesting employment on the expanding Polish market in telecommunications services, mobile communications, information technology, television.

Continuing education courses are addressed to technical staff from a number of dynamically developing Polish businesses such as telecommunications network operators, banks, local and governmental organizations. The 1996 offer included:

- Postgraduate Course on Radiocommunication;
- Course for National Radiocommunication Agency PAR.

At all levels, lectures are delivered by experienced academic staff including 9 professors and 34 assistant professors. Laboratories and design seminars take advantage of the Institute's computer network, equipment, and professional software. There are over 10 student laboratories in the Institute, for example: the Radiocommunication Laboratory, Biomedical Laboratory, Measuring Systems Laboratory (equipped with Hewlett-Packard and National Instruments hardware and software), Computer Laboratory. While the above facilities are comparable to those offered by other units of the Faculty, a unique feature of the Institute of Radioelectronics consists in the measuring and production equipment available, fundamental for the Institute's engineering projects but also providing hands-on experience for its students. The equipment comprises, among others: an anechoic chamber and sound studio, a BMT-1000 MRI tomograph, an HP network analyser.

1.2. Board of Directors

Director of the Institute:

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Deputy Director for Research

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Deputy Director for Academic Affairs

Piotr Brzeski, Ph.D., Assistant Professor
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Deputy Director for Technical Affairs

Zbigniew Dargiel, M.Sc., Head R&D Engineer
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1.3. Organisation of the Institute

The Institute of Radioelectronics consists of seven research and teaching divisions, viz.:

- Radiocommunications Division;
- Television Division;
- Electroacoustics Division;
- Radio Engineering Devices;
- Microwave Engineering Division;
- Piezoelectric Measurement Division;
- Medical and Nuclear Electronics Division.

The structure of the Institute includes also Head Office Library, Financial Section and Supply Section.

1.3.1. Radiocommunications Division

Head of Division

Jacek Jarkowski, Ph.D., Assistant Professor
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Senior academic staff

Tomasz Buczkowski, Ph.D.	Assistant Professor
Krzysztof Czerwiński, Ph.D.	Assistant Professor
Tomasz Kosiło, Ph.D.	Assistant Professor
Karol Radecki, Ph.D.	Assistant Professor
Waldemar Kielek, D.Sc.	Associate Professor (emeritus)
Stefan Hahn, D.Sc.	Full Professor (emeritus)

Junior academic staff

Henryk Chaciński, M.Sc.,	Lecturer
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Technical and administrative staff

Kajetana Snopek, M.Sc.
 Janina Chmielak

Teaching activities carried out in the Radiocommunications Division cover most of basic problems in radiocommunication systems, antennae and signal processing. Research activities are focused on specific problems in radiocommunication such as:

- digital modulations,
- optimizing methods of antenna synthesis,
- multidimensional signals theory,
- mobile systems.

Current research topics include:

- theory and applications of multidimensional complex signals,
- theory and applications of two-dimensional signal - frequency domain distributions,
- the application of Hilbert transform for antenna radiation pattern forming and optimizing,
- digital modulations broadcasting in AM bands,
- application of GDS for selected geodetic measurements,
- health and environment aspects of electronics.

1.3.2. Television Division

Head of Division

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Senior academic staff

Krzysztof Derzakowski, Ph.D.	Assistant Professor
Zdzisław Kozłowski, Ph.D.	Assistant Professor
Marek Rusin, Ph.D.	Assistant Professor

Junior academic staff

Jerzy Kondarewicz, M.Sc.	Lecturer (from 01.11.96, to 31.10.96 - tech. staff)
Andrzej Buchowicz, M.Sc.	Assistant
Tomasz Krzymień, M.Sc.	Assistant
Jacek Marzyjanek, M.Sc.	Assistant (from 01.11.96)
Marek Pietraszak, M.Sc.	Assistant
Dariusz Działkowski, M.Sc.	Ph.D. Student
Grzegorz Siemek, M.Sc.	Ph.D. Student
Wojciech Kazubski, M.Sc.	Ph.D. Student

Technical staff

Tomasz Smakuszewski, M.Sc.

Television Division conducts scientific and applied research in the area of terrestrial, satellite and cable television systems, analogue and digital components of television systems, broadcasting equipment as well as digital image processing. Specific research topics in 1996 included:

- selected topics in the design of cable television networks,
- computer graphics in TV postproduction,
- dielectric resonators - analysis, design techniques, visualization of the electromagnetic field in a resonator,
- image compression techniques - wavelet transform, vector quantization, high compression ratio algorithms,
- algorithms of image motion detection and estimation,
- nonlinear filters for colour image processing.

1.3.3. Electroacoustics Division

Head of Division

Andrzej Leszczyński, Ph.D., Assistant Professor
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Senior academic staff

Ewa Kotarbińska, Ph.D.	Assistant Professor
Jerzy Narkiewicz-Jodko, Ph.D.	Assistant Professor
Maria Tajchert, Ph.D.	Assistant Professor

Junior academic staff

Jan Paluchowski, M.Sc.	Assistant
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Technical staff

Andrzej Aronowski

The activities of the Division concern audioacoustics and ultrasonic techniques including investigations, measurements, and applications. They are focused on:

- design and measurement of electroacoustic transducers,
- investigation and modelling of acoustic field distribution,
- noise control and active noise reduction,
- psychoacoustics,
- architectural and industrial acoustics,
- sound studio techniques,
- hearing protection.

The Division is equipped with an anechoic chamber and sound studio.

Current research topics include:

- active noise reduction systems applied to acoustic waveguides,
- high frequency piezoelectric sensors for automation applications,
- detection of auditory warning signals in the presence of industrial noise.

1.3.4. Radio Engineering Division

Head of Division

Jan Ebert, D.Sc., Full Professor
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Senior academic staff

Roman Z. Morawski, D.Sc.	Professor
Konrad Adamowicz, Ph.D.	Assistant Professor
Mirosław Mikołajewski, Ph.D.	Assistant Professor
Juliusz Modzelewski, Ph.D.	Assistant Professor
Andrzej Podgórski, Ph.D.	Assistant Professor
Krzysztof Puczko, Ph.D.	Assistant Professor
Wiesław Winiecki, Ph.D.	Assistant Professor

Junior academic staff

Andrzej Miękina, M.Sc.	Assistant
Anna Kalinowska, M.Sc.	Assistant (to 30.06.96)
Piotr Sokołowski, M.Sc.	Assistant (to 18.07.96)
Piotr Kluk, M.Sc.	Ph.D. Student
Tomasz Szafranski, M.Sc.	Ph.D. Student
Nguyen Lien Huong, M.Sc.	Ph.D. Student

Technical staff

Ryszard Leoniak, M.Sc.
 Andrzej Owczarek, M.Sc.

The activities of the Division concern fundamental and applied research associated with high-frequency techniques, metrology, instrumentation and measuring systems. They are focused on:

- improving the efficiency of high-frequency power sources and other high-frequency devices,
- improving the quality of measurement using signal-processing techniques,
- designing automated computer-based measuring systems.

Current research topics include:

- computer-aided analysis and synthesis of class D/E resonant amplifiers, resonant rectifiers, resonant dc/dc converters, uninterruptible power suppliers,
- software environment for computer-aided design of algorithms of measurement-signal processing, methods for reconstruction of measurands and methods for calibration of measuring systems,
- software environment for computer-aided design of measuring systems, virtual instrumentation, plug-in boards for data acquisition, IEEE-488 equipment, measuring systems for the measurement of wide-range broadcasting signals,
- computer-aided spectrophotometry for applications in the monitoring of the natural environment,

- portable signal analysers for technical diagnostics and the monitoring of the natural environment.

1.3.5. Microwave Engineering Division

Head of Division

Tadeusz Morawski, D.Sc., Full Professor
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Senior academic staff

Wojciech Gwarek, D.Sc.	Professor
Stanisław Rosłonec, D.Sc.	Professor
Małgorzata Celuch-Marcysiak, Ph.D.,	Assistant Professor (from 25.11.1996)
Krzysztof Kowalski, Ph.D.	Assistant Professor
Przemysław Miazga, Ph.D.	Assistant Professor
Andrzej Więckowski, Ph.D.	Assistant Professor
Jolanta Zborowska, Ph.D.	Assistant Professor

Junior academic staff

Wojciech Wojtasiak, M.Sc.	Senior Lecturer (from 1.10.1996, to 30.09.96 - Lecturer)
Maciej Sypniewski, M.Sc.	Assistant
Mirosław Andrzejewski, M.Sc.	Ph.D. Student
Dariusz Bednarczyk, M.Sc.	Ph.D. Student
Dariusz Górlicki, M.Sc.	Ph.D. Student
Daniel Gryglewski, M.Sc.	Ph.D. Student
Tahar Habib, M.Sc.	Ph.D. Student
Andrzej Kozak, M.Sc.	Ph.D. Student
Marek Kukier, M.Sc.	Ph.D. Student
Witold Mizera, M.Sc.	Ph.D. Student
Phan Than Bang, M.Sc.	Ph.D. Student
Konrad Szustak, M.Sc.	Ph.D. Student

Technical staff

Krzysztof Robaczyński, M.Sc.
 Mirosław Lubiejewski

The Microwave Technology Division conducts scientific and applied research in the area of electromagnetic field theory, microwave theory and techniques, measurement techniques for very high frequency range as well as computer-aided design, data acquisition and data processing. Specific research topics in 1996 included:

- design of high-frequency systems for satellite communications (generators, synthesisers, modulators, amplifiers, antennae),
- methods of synthesis and computer-aided design of passive and active microwave circuits (couplers, summaters and dividers, switches, transistor circuits),
- design of modern computer-aided measuring systems (network analysers, power and frequency meters, specialized systems for microwave diode and transistor measurements), and development of their hardware and software components,
- development of numerical methods and implementation of computer programs for full-wave analysis and design of two- and three-dimensional microwave circuits (filters, matching circuits, uniform and periodic guiding structures, polarizers, antennas),
- development of nonlinear programming and artificial intelligence methods, and their application to the automated design of microwave circuits.

1.3.6. Piezoelectric Measurement Division

Head of Division

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Senior academic staff

Jacek Cichoński, Ph.D. Assistant Professor

Junior academic staff

Jerzy Kołakowski, M.Sc. Assistant

Technical staff

Stanisław Żmudzin, M.Sc.

The division carries out intensive work in the field of radiocommunication measurement, radiomonitoring and land mobile communication. Its main interests include:

- measurement methods and techniques,
- high-frequency measuring systems intended for testing radiocommunication equipment,
- radiomonitoring methods and systems,
- cellular communication systems (GSM, TETRA).

Currently our activity is focused on:

- development of mobile radiomonitoring systems,
- training in cellular systems.

1.3.7. Nuclear and Medical Electronics Division

Head of Division

Zdzisław Pawłowski, D.Sc., Full Professor
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Senior academic staff

Adam Piątkowski, D.Sc.	Full Professor
Piotr Brzeski, Ph.D.	Assistant Professor
Marek Karolczak, Ph.D.	Assistant Professor
Marian Kazubek, Ph.D.	Assistant Professor
Janusz Marzec, Ph.D.	Assistant Professor
Jacek Mirkowski, Ph.D.	Assistant Professor
Lech Padee, Ph.D.	Assistant Professor
Artur Przelaskowski, Ph.D.	Assistant Professor
Roman Szabatin, Ph.D.	Assistant Professor
Krzysztof Zaremba, Ph.D.	Assistant Professor
Waldemar Scharf, Ph.D.	Assistant Professor (emeritus)

Junior academic staff

Paweł Błociszewski, M.Sc.	Senior Lecturer (from 1.06.96, to 31.05.96 - Lecturer)
Tomasz Olszewski, M.Sc.	Lecturer (from 1.10.96 - permanent half time)
Piotr Bogorodzki, M.Sc.	Assistant.
Bogumił Konarzewski, M.Sc.	Assistant

Ewa Piątkowska-Janko, M.Sc.	Assistant
Grzegorz Domański, M.Sc.	Ph.D. Student
Wojciech Frey, M.Sc.	Ph.D. Student
Waldemar Smolik, M.Sc.	Ph.D. Student
Jarosław Wasielewski, M.Sc.	Ph.D. Student

Technical and administrative staff

Marta Bukowska-Korol, M.Sc.
 Dariusz Ćwiek, M.Sc.
 Tomasz Jamrógiewicz, M.Sc.
 Tomasz Olszewski, M.Sc. (up to 30.09.96 - permanent basis, from 1.10.96 - permanent half time)
 Andrzej Wasilewski
 Joanna Witkowska

The research and teaching activities carried out in the Nuclear and Medical Electronics Division are concentrated on Biomedical Engineering. Research in this interdisciplinary area covers a broad range of topics and integrates sophisticated electronics and information technology with elements of medical knowledge. The group's research is focused on following topics:

- nuclear medicine (emission tomography: SPECT, PET),
- quantitative computer-aided tomography,
- magnetic resonance imaging,
- analogue and digital radiography,
- medical image processing and recognition,
- methods and instrumentation for electrocardiography and electroencephalography,
- medical applications of isotope techniques,
- biomedical accelerators.

Areas of recent studies include:

- methodology and apparatus for non-invasive determination of bone density and concentration of heavy metals in bone,
- application of the vector space transformations for improving the quality of ECG recorded signals,
- multimodal imaging of topographic, tomographic and functional studies in medicine,
- correlated methods for the investigation of neurosystems by NMR and SPECT tomography,
- MR imaging sequence optimisation for better contrast resolution in heart and large vessels examination,
- field homogeneity in MRI tomography improvement with combined „passive” and „active” approach,
- expert systems for high resolution ECG with P-wave averaging technique,
- application of wavelet transform for echocardiographic images' quality improvement and for image data compression,
- algorithms for 3D brain imaging,
- dynamic tomographic studies (aided method of early diagnosis of brain strokes),
- digital structural radiography,
- X-ray stereoscopy.

2. STAFF

2.1. Senior academic staff

Konrad Adamowicz

M.Sc. ('64), Ph.D. ('76); measurement and instrumentation; Assistant Professor, Radio Engineering Division; Scientific Secretary of the Metrology and Instrumentation Committee, Polish Academy of Sciences ('93-'96); Member of the Education Commission of the Metrology and Instrumentation Committee, Polish Academy of Sciences ('93-'96); Member of the Measurement Committee of the Polish Society for Measurement, Automatic Control and Robotics POLSPAR ('92-); [Edu2], [Edu88]; [MSc19], [MSc23]; [Pro13b], [Pro27]; [Pro53]; [Pub37], [Pub38]; [Rep1], [Rep2], [Rep3].

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Paweł S. Błociszewski

M.Sc. ('85); biomedical engineering; Senior Lecturer, Medical and Nuclear Electronics Division; [Edu7], [Edu25]; [Pro19]; [Pub92].

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Piotr A. Brzeski

M.Sc. ('70), Ph.D. ('82); biomedical engineering; Assistant Professor, Nuclear and Medical Electronics Division; Deputy Director for Academic Affairs of the Institute of Radioelectronics ('93-); Member of the Faculty Council ('90-); Member of the Dean's Financial Committee ('93-); Member of the European Association of Nuclear Medicine ('89-); [Edu13]; [MSc34]; [Pro19], [Pro43]; [Pub92]; [Con45], [Con49].

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Tomasz Buczkowski

M.Sc. ('67), Ph.D. ('78); electronics and telecommunications; Assistant Professor, Radiocommunications Division; Head of the Electronic Aids for the Handicapped and the Elderly Laboratory; Chairman of the ITU-R (CCIR) Study Group 7 „Time & Frequency” ('83-); Member of the Scientific Advisory Board, Polish Association for the Blind; Central Bureau of Geodesy and Cartography (GUG) Award in Research; SEP Publication Award; [Edu43], [Edu77], [Edu90]; [Pro6]; [Pub109]; [Con29], [Con30], [Con50], [Con51].

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Jacek Cichocki

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Małgorzata Celuch-Marcysiak

M.Sc. ('88), Ph.D. ('96); microwaves; Assistant Professor, Microwave Technology Division; [PhD1]; [Pro2], [Pro16], [Pro34]; [Pub6], [Pub9], [Pub35], [Pub36], [Pub44], [Pub45], [Pub46], [Pub47], [Pub51], [Pub52], [Pub66], [Pub85]; [Con8], [Con9], [Con19], [Con20], [Con46], [Con47], [Con54], [Con60]; [Rep14].

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Krzysztof Czerwiński

M.Sc. ('68), Ph.D. ('86); electronics and telecommunications; Assistant Professor, Radiocommunications Division; Vice-chairman of the ITU-R (CCIR) Study Group 7 „Time and Frequency” ('83-); Rector's Award in Research; Central Bureau of Geodesy and Cartography (GUG) Award in Research; SEP Publication Award; [Edu32], [Edu47], [Edu61], [Edu90], [Edu95]; [Pro6]; [Pub7].

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Krzysztof Derzakowski

M.Sc. ('84), Ph.D. ('91); radio-frequency engineering, microwave technique; Assistant Professor, Television Division; Head of the student laboratory of Microprocessors ('96-); Ministry of National Education Awards in Research ('91), ('95), Rector's Award in Research ('87), URSI Award for Young Scientists ('89); [Pro23], [Pub8], [Pub48], [Pub69], [Pub71], [Pub72]; [Con9], [Con22], [Con38].

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Jan T. Ebert

M.Sc. ('56), Ph.D. ('63), D.Sc. ('79), Prof. Title ('82); radio frequency engineering, radio transmitters, power electronics, industrial electronics; Full Professor ('94-), Radio Engineering Division, Head ('70-); Dean of the Faculty ('85-'91), Director of the Institute ('75-'80), Member of the Senate ('81-'93, '96-), Chairman of the Senate Committee on Academic Ethics ('96-), Member of the Senate Committee on Education ('96-), Member of the FEIT Council ('59), Chairman of the Curriculum Committee I ('93-'96), Chairman of the FEIT Committee on Education ('96-), Member of the Rector's Advisory Board on Awards and Distinctions ('90), Member of the Electronics and Telecommunication Committee, Polish Academy of Sciences ('67-), Member of the State Committee on IEE Academic Fellows ('93-); Ministry of National Education Awards, Ministry of Defence Award; [Edu70]; [Pro1], [Pro12], [Pro42], [Pro45], [Pro51]; [Pub35]; [Rep5], [Rep6], [Rep7].

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Adam J. Fiok

B.Sc. ('54) M.Sc. ('59), Ph.D. ('64), D.Sc. ('74), Prof. Title ('91); measurement and instrumentation; Prof. ('91-), Piezoelectric Measurement Division, Head ('75-); Member of the Faculty Council ('74-), Deputy Director for Research of the Institute of Radioelectronics ('75-'78, '81-

'84); Scientific Secretary ('83-'86) and Vice-Chairman ('86-'95) of the Metrology and Instrumentation Committee, Polish Academy of Sciences; Member of IMEKO General Council ('84-) and Chairman of IMEKO TC-4 ('89-); Vice-Chairman ('92-) of the Polish Society for Measurement, Automatic Control and Robotics (POLSPAR); Member of the Polish Society of Theoretical and Applied Electrotechnics; [Edu60], [Edu64]; [Pub57], [Pub106], [Pub107]; [Pro7], [Pro25], [Pro52]; [Con28].

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3. TEACHING ACTIVITIES (academic year 1995/96)

3.1. Basic courses

[Edu1] <i>Analysis of Measurement Data</i> (Analiza danych pomiarowych - ADP); 3h/week; semester 6; Z. Pa-włowski.	[Edu13] <i>Orientation 3</i> (Orientacja 3 - OR3); 1h/week; semester 3; P. Brzeski.
[Edu2] <i>Digital Measurement Technique</i> (Cyfrowa technika pomiarowa - CTP); 3h/week; semester 6; K. Adamowicz.	[Edu14] <i>Orientation 4</i> (Orientacja 4 - OR4); 1h/week; semester 4; M. Karolczak.
[Edu3] <i>Digital Processing of Nuclear Signals</i> (Cyfrowe przetwarzanie sygnałów jądrowych - CPSJ); 3h/week; semester 6; M. Karolczak.	[Edu15] <i>Orientation 5</i> (Orientacja 5 - OR5); 1h/week; semester 5; M. Karolczak.
[Edu4] <i>Detection of Nuclear and Medical Signals - Lab</i> (Detekcja sygnałów jądrowych i medycznych - DSJML); 2h/week; semester 7; Z. Pawłowski.	[Edu16] <i>Basics of Electroacoustics</i> (Podstawy elektroakustyki - PEA); 3h/week; semester 6; A. Leszczyński, J. Narkiewicz-Jodko.
[Edu5] <i>Detection of Nuclear and Medical Signals</i> (Detekcja sygnałów jądrowych i medycznych - DSJM); 2h/week; semester 6; Z. Pawłowski.	[Edu17] <i>Basics of Medical Science</i> (Podstawy nauk medycznych - PNMED); 3h/week; semester 5; G. Pawlicki.
[Edu6] <i>Electronics III</i> (Elektronika III - ELKAIII); 4h/week; semester 4; M. Karolczak.	[Edu18] <i>Basics of Microwave Technique - Lab.</i> (Podstawy techniki mikrofalowej - PTML); 2h/week; semester 6; W. Wojtasiak.
[Edu7] <i>Medical Informatics</i> (Informatyka medyczna - IM); 4h/week; semester 7; P. Błociszewski.	[Edu19] <i>Basics of Computer Technique</i> (Podstawy techniki komputerowej - PTKO); 4h/week; semester 1; A. Więckowski.
[Edu8] <i>Numerical Methods</i> (Metody numeryczne - MNM); 3h/week; semester 3; R. Z. Morawski.	[Edu20] <i>Basics of Microwave Technique</i> (Podstawy techniki mikrofalowej - PTM); 3h/week; semester 5; K. Kowalski.
[Edu9] <i>Methods of Image Recognition</i> (Metody rozpoznawania obrazów - MRO); 3h/week; semester 7; M. Kazubek.	[Edu21] <i>Basics of High Frequency Technique - Lab.</i> (Podstawy techniki w.cz. - TWCZ); 2h/week; semester 4; W. Wojtasiak.
[Edu10] <i>Nucleonics</i> (Nukleonika - NK); 3h/week; semester 5; W. Scharf.	[Edu22] <i>Basics of Television</i> (Podstawy telewizji - PT); 3h/week; semester 6; Z. Kozłowski.
[Edu11] <i>Orientation 1</i> (Orientacja 1 - OR1); 1h/week; semester 1; W. Gwarek.	[Edu23] <i>Fields and Waves</i> (Pola i fale - POFA); 3h/week; semester 3; T. Morawski, W. Gwarek.
[Edu12] <i>Orientation 2</i> (Orientacja 2 - OR2); 1h/week; semester 2; A. Buchowicz.	[Edu24] <i>Programming</i> (Programowanie - PROG); 5h/week; semester 2; A. Podgórski.
	[Edu25] <i>Programming 2</i> (Programowanie 2 - PROG2); 3h/week; semester 5; P. Błociszewski.

- [Edu26] *Computer Systems* (Systemy komputerowe - SYKO); 3h/week; semester 4; T. Jamrógiewicz.
- [Edu27] *Operating Systems* (Systemy operacyjne - SOP); semester 5; M. Sypniewski.
- [Edu28] *Measuring Systems* (Systemy pomiarowe - SPOM); 6h/week; semester 5; W. Winięcki.
- [Edu29] *Measuring Systems - Lab.* (Systemy pomiarowe - SPRL); 2h/week; semester 7 ; W. Winięcki.
- [Edu30] *Measuring Systems in Radioelectronics* (Systemy pomiarowe w radioelektronice - SPR); 2h/week; semester 4; W. Winięcki.
- [Edu31] *Microprocessor Technique* (Technika mikroprocesorowa - TMI); 3h/week; semester 6; J. Marzec.
- [Edu32] *Microprocessor Techniques* (Technika mikroprocesorowa - TMIK); 4h/week; semester 5; K. Czerwiński.
- [Edu33] *Microprocessor Techniques - Lab.* (Technika mikroprocesorowa - TML); 2h/week; semester 7; T. Krzymień, B. Konarzewski.
- [Edu34] *Theory of Modulation and Detection* (Teoria modulacji i detekcji - TMD); 3h/week; semester 5; T. Kosiło.
- [Edu35] *Theory of Elektromagnetic Field* (Teoria pola D - TPD); 4h/week; semester 4; W. Gwarek, Prof., D.Sc.
- [Edu36] *Theory of Signals and Modulations* (Teoria sygnałów i modulacji - TSIM); 4h/week; semester 4; T. Kosiło, K. Radecki.
- [Edu37] *Digital Systems - Lab.* (Układy cyfrowe - UCL); 2h/week; semester 5; P. Miazga.
- [Edu38] *Digital Circuits - Lab.* (Układy logiczne - UKLO); 2h/week; semester 4; P. Miazga.
- [Edu38a] *Noise Control and Environmental Acoustics* (Akustyka środowiska - AS); 4h/week; semester 3; E. Kotarbińska.
- [Edu43] *Ecological and Health Aspects of Electronics* (Aspekty ekologiczne i zdrowotne elektroniki - AZE); 3h/week; elective; T. Buczkowski.
- [Edu44] *Digital Measurements - Lab.* (Cyfrowa technika pomiarowa - CTPL); 2h/week; elective; A. Podgórski.
- [Edu45] *Digital Image Processing* (Cyfrowe przetwarzanie obrazów - CPOB); 3h/week; elective ; M. Kazubek.
- [Edu46] *Digital Signal Processing* (Cyfrowe przetwarzanie sygnałów - CPSR); 2h/week; elective; R. Z. Morawski.
- [Edu47] *Programmable Digital Systems* (Cyfrowe układy programowalne - CUP); 5h/week; elective; M. Karolczak, K. Czerwiński.
- [Edu48] *Electronic Medical Instrumentation* (Elektroniczna aparatura medyczna - EAM); 3h/week; elective; L. Padee.
- [Edu49] *Electronic Medical Instrumentation - Lab.* (Elektroniczna aparatura medyczna - EAML); 2h/week; elective; L. Padee.
- [Edu50] *Loudspeakers and Loudspeaker Enclosures* (Głośniki i obudowy głośnikowe - GOG); 2h/week; elective; J. Narkiewicz-Jodko.
- [Edu51] *Data Compression* (Kompresja danych - KODA); 2h/week; elective; A. Przelaskowski.
- [Edu52] *Data Compression 2* (Kompresja danych 2 - KODA2); 3h/week; elective; A. Przelaskowski.
- [Edu53] *Electroacoustics A - Lab.* (Laboratorium elektroakustyki A - EAAL); 2h/week; elective; J. Narkiewicz-Jodko.
- [Edu54] *Electroacoustics B - Lab.* (Laboratorium elektroakustyki B - EABL); 2h/week; elective; A. Leszczyński.
- [Edu55] *Medical Image Devices* (Medyczne urządzenia obrazujące - MUO); 4h/week; elective; R. Szabatin.
- [Edu56] *Methods and Algorithms for Processing Measurement Signals* (Metody i algorytmy przetwarzania sygnałów pomiarowych - MAP); 3h/week; elective; R. Z. Morawski.
- [Edu57] *Methods and Equipment for Organ Structure Visualisation* (Metody i urządzenia do wizualizacji struktur narządowych - MWSN); 3h/week; elective; R. Szabatin.
- [Edu58] *Metrology and Experimentation Techniques* (Metrologia i technika eksperymentu - MTE); 2h/week; elective; J. Jaworski.
- [Edu59] *Acoustic Measurements* (Miernictwo akustyczne - MA); 2h/week; elective; M. Tajchert.

3.2 Advanced courses

- [Edu39] *Dosimetry and Spectrometric Measurements* (Dozymetria i pomiary spektrometryczne - DPS); 4h/week; semester 8; A. Piątkowski.
- [Edu40] *Radioelectronics Laboratory* (Laboratorium radioelektroniki - LR); 4h/week; semester 8; J. Modzelewski.
- [Edu41] *Biomedical Accelerators* (Akceleratory biomedyczne - ABM); 2h/week; elective; W. Scharf.
- [Edu42] *Antennae and Radiowave Propagation* (Anteny i propagacja fal - APF); 2h/week; elective; J. Jarkowski.

- [Edu60] *Radioelectronic Measurements* (Miernictwo radioelektroniczne - MR); 2h/week; elective; A. Fiok.
- [Edu61] *Microprocessors and their Applications* (Mikroprocesory i ich zastosowania - MIZ); 3h/week; elective; K. Czerwiński.
- [Edu62] *Sound Recording and Modelling* (Odbiór i kształtowanie dźwięku - OKD); 2h/week; elective; M. Tajchert.
- [Edu63] *Basics of Radiocommunications* (Podstawy radiokomunikacji - PRR); 2h/week; elective; W. Kielek.
- [Edu64] *Radio Equipment Measurements* (Pomiary urządzeń radiowych - PURA); 2h/week; elective; A. Fiok, J. Cichocki.
- [Edu65] *Microwave Microstrip Circuit Design* (Projektowanie mikrofalowych układów NLP - NLP); 4h/week; elective; J. Zborowska.
- [Edu66] *Satellite Broadcasting* (Radiodyfuzja satelitarna - RDS); 2h/week; elective; J. Jarkowski.
- [Edu67] *Mobile Radio Communication* (Radiokomunikacja ruchoma lądowa - RRL); 3h/week; elective; T. Kosiło.
- [Edu68] *GSM System* (System telefonii komórkowej GSM - GSM); 2h/week; elective; J. Cichocki.
- [Edu69] *Artificial Neural Networks in Medicine* (Sztuczne sieci neuronowe w medycynie - SESN2); 3h/week; elective; K. Zaremba.
- [Edu70] *Signal Transmitting and Receiving* (Technika nadawania i odbioru - TNO); 2h/week; elective; J. Ebert.
- [Edu71] *Television Reception Techniques* (Technika odbioru telewizyjnego - TOT); 4h/week; elective; M. Rusin.
- [Edu72] *Cable Television* (Telewizja przewodowa - TVP2); 4h/week; elective; J. Modelski.
- [Edu73] *Satellite Television* (Telewizja satelitarna - TVS); 3h/week; elective; J. Modelski.
- [Edu74] *Computer Tomography* (Tomografia komputerowa - TOM); 2h/week; elective; J. Mirkowski.
- [Edu75] *NMR Tomography* (Tomografia rezonansu magnetycznego - TRM); 4h/week; elective; A. Piątkowski.
- [Edu76] *Digital Signal Transmission* (Transmisja cyfrowa sygnałów - TCS); 5h/week; elective; T. Kosiło.
- [Edu77] *Data Transmission in Computer Systems* (Transmisja danych w systemach komputerowych - TDSK); 3h/week; elective; T. Buczkowski.
- [Edu78] *Nuclear Medicine Equipment* (Urządzenia medycyny nuklearnej - UMN); 4h/week; elective; W. Scharf.
- [Edu79] *Contemporary Topics in Television* (Współczesne problemy telewizji - WPT); 2h/week; elective; M. Rusin.
- [Edu80] *Contemporary Applications of Microwaves* (Współczesne zastosowania mikrofal - WZN); 3h/week; elective; J. Modelski.
- [Edu81] *Application of DSP in Instrumentation* (Zastosowania procesorów sygnałowych - ZPS); 2h/week; elective; A. Podgórski.
- [Edu82] *Analysis of Electromagnetic Fields* (Metody analizy pól elektromagnetycznych - MAPE); 3h/week; Ph.D. studies; T. Morawski, W. Gwarek.

3.3. Special courses

Abbreviations used in the description of the courses:

SPR - Postgraduate Course on Radiocommunication

PAR - Course for National Radiocommunication Agency PAR (April-May 1996)

- [Edu83] *Antennae for Telecommunication Applications* (Anteny radiokomunikacyjne, UHF i mikrofalowe - ARM); 24h; SPR; S. Rostoniec.
- [Edu84] *Digital Signal Transmission* (Cyfrowa transmisja sygnałów - CTS); 28h; SPR; T. Kosiło.
- [Edu85] *Digital Signal Processing* (Cyfrowe przetwarzanie sygnałów - CPS); 16h; SPR; K. Kulpa.
- [Edu86] *Digital Cellular Systems* (Cyfrowe systemy komórkowe - CSK); 16h; SPR; J. Cichocki, Assist. Prof., Ph.D., J. Kołakowski.
- [Edu87] *Computer-aided Radiomonitoring* (Komputerowe monitorowanie emisji - KME); 4h; SPR; J. Cichocki, J. Kołakowski.
- [Edu88] *Computer Controlled Measurement and Data Processing* (Komputerowe sterowanie i przetwarzanie danych - KSP); 37h; SPR; K. Adamowicz, A. Więckowski, W. Winiecki.
- [Edu89] *Radio Links and Satellite Communication* (Linie radiowe i łączność satelitarna - LR); 20h; SPR; J. Zygierewicz.
- [Edu90] *Microprocessors and Programmable Logic Circuits* (Układy mikroprocesorowe i programowalne - MUP); 12h; SPR; K. Czerwiński, T. Buczkowski.
- [Edu91] *Microwave Techniques* (Problemy techniki mikrofalowej - PTMI); 6h; SPR; K. Kowalski.
- [Edu92] *Theory of E-M Fields and Microwaves* (Problemy teorii pola i techniki mikrofalowej - PTM); 20; SPR; K. Kowalski.

- [Edu93] *Radiowave propagation* (Propagacja fal - PF); 16h; SPR; J. Jarkowski. radiofonii i radiokomunikacji - MSRR); 6h; PAR; T. Kosiło.
- [Edu94] *Wide-band Systems in Telecommunication* (Systemy szerokopasmowe w telekomunikacji - SST); 16h; SPR; A. Dąbrowski. [Edu104] *Mobile Communication* (Radiokomunikacja ruchoma lądowa - RRL); 6h; PAR; T. Kosiło.
- [Edu95] *Microprocessor Engineering* (Technika mikroprocesorowa - TMP); 20h; SPR; K. Czerwiński. [Edu105] *Digital Broadcasting System DAB* (Radiofonia cyfrowa DAB - DAB); 6h; PAR; T. Kosiło, K. Radecki.
- [Edu96] *Modern Radiocommunication and Broadcasting Systems* (Współczesne systemy radiokomunikacyjne i radiofoniczne - WRR); 32h; SPR; T. Kosiło. [Edu106] *GSM System* (System telefonii komórkowej GSM - GSM); 8h; PAR; J. Cichocki, J. Kołakowski.
- [Edu97] *Contemporary Telecommunication Networks* (Współczesne sieci telekomunikacyjne - WST); 20h; SPR; M. Dąbrowski. **3.4. International co-operation**
- [Edu98] *Contemporary Television Systems I* (Współczesne systemy telewizyjne I - STV); 20h; SPR; M. Rusin. [Edu107] TEMPUS MJEP-9006: „**Courses and Projects for Students in Pure and Applied Physics**” (Sweden, Italy, rat Britain); **Z. Pawłowski, Prof., D.Sc.**, (1995-1996), **K. Zaremba, Ph.D.**, (1996-), Z. Pawłowski; 1995-1998
- [Edu99] *Contemporary Television Systems II* (Współczesne systemy telewizyjne II - WST); 20h; SPR; J. Modelski. [Edu108] TEMPUS JEP-11117: „**Interdisciplinary Laboratory of Informatics in Medical Imaging Diagnostics**” **A. Piątkowski, Prof., D.Sc.**, P. Bogorodzki, E. Piątkowska-Janko; 1996-1999
- [Edu100] *Interference in Radio Systems* (Zakłócenia w systemach radiowych - ZR); 16h; SPR; W. Gwarek. [Edu109] TEMPUS JEP-7403-94: “**Modern Technologies in Telecommunications for New Polish Educational Systems**” (Belgium, Italy, Great Britain, Portugal); **J. Modelski, Prof., D.Sc.**, T. Kosiło; 1994-1997
- [Edu101] *Radiowave Propagation* (Propagacja fal - PF); 8h; PAR; J. Jarkowski.
- [Edu102] *Digital Processing of Signals in Radiocommunication* (Cyfryzacja sygnałów radiowych i radiokomunikacyjnych - CSRR); 8h; PAR; T. Kosiło.
- [Edu103] *Modulation Techniques in Radiocommunication and Broadcasting* (Modulacje stosowane w

4. RESEARCH PROJECTS

4.1. Projects granted by the University

Statutory projects

- [Pro1] **High-efficiency Supply Circuits for Electronic Equipment** (Wysokosprawne układy zasilające do sprzętu elektronicznego)
Jan Ebert, Prof., D.Sc.,
J. Modzelewski, A. Owczarek;
01.04.95-31.03.96

Novel supply circuits for applications in modern electronic equipment have been built and tested. The circuits are based on two new methods of output power regulation in switch-mode power supplies. The first method utilises a single-transistor synchronous regulator to regulate the circuit output power, and the second method applies output power combining. The circuits operated at a constant frequency (0.5 MHz and 1 MHz) and achieved high efficiency (>85%) for maximum output power. An important advantage of the circuits is that their efficiency decreases only slightly with the decrease of their output

power. For one fourth of maximum output power their efficiency was still higher than 70%.

[Rep5]

- [Pro2] **Modern Methods of Analysis of Electromagnetic Fields and Microwave Circuit Design** (Nowoczesne metody analizy pól elektromagnetycznych oraz analizy i projektowania układów mikrofalowych)
Tadeusz Morawski, Prof., D.Sc.,
W. Gwarek, M. Celuch-Marcysiak, J. Zborowska,
K. Kowalski, W. Wojtasiak, W. Kazubski;
01.04.95 - 31.03.96

The research consisted of three different parts:

- design methods for generators and amplifiers in radio-location transmitters,
- comparison of selected methods of time-domain electromagnetic modelling in application to waveguide discontinuities,
- modelling of thermal phenomena in Gunn diodes using the finite difference method.

[Rep.14]

[Pro3] Computerized Control System for TV Broadcast Equipment (Komputerowe sterowanie telewizyjnych urządzeń studyjnych)

Józef Modelski, Prof., D.Sc.,

J. Kondarewicz, T. Krzymień, M. Pietraszek,
T. Smakuszewski;

01.04.95 - 31.03.96

The software for image sequence processing was developed in the first part of this work. It consists of two main parts: a software for controlling the frame-grabber card and interface for the time-lapse VTR. The software permits the transfer of images recorded on the VTR tape to the PC computer for further processing. Processed images can be later recorded on tape. The software has been used to study algorithms of image sequence processing.

[Pro4] Radiation Methods in Medical Technique (Metody radiacyjne w technikach medycznych)

Zdzisław Pawłowski, Prof., D.Sc.,

A. Piątkowski, M. Kazubek, R. Szabatin,
J. Mirkowski;

01.04.95 - 31.03.96

- a) Hardware upgrade for BMT-1000 (BRUCKER) tomograph:
 - measurement and shining system for magnetic field homogeneity,
 - design of NMR probes for magnetic field measurement,
 - design and testing of „FLUX” stabilizer.
- b) X ray stereoscopy:
 - development of 3D object interpolation method based on 2D radiograms.
- c) Development of research methods for Nuclear Medicine:
 - gammacamera mounting,
 - computer interface work-out,
 - reconstruction programme based on ML algorithm work-out.
- d) Analysis of the utilization possibilities of tomographic reconstruction techniques in small number projections term:
 - data presentation and phantom buildings programme work out,
 - measurement simulation programme work-out,
 - convolution track projection programme work-out,
 - tests.
- e) Spectrometric methods in medical analytical testing:
 - comparative analysis of elemental content of human tissues,
 - determination of scattering coefficient in tissue,
 - determination of coherent and incoherent scattering radiation distribution in human tissue,
 - measurement conditions optimization in X-Ray fluorescence analysis.

[Pro5] Implementation and Investigation of Selected Algorithms for Calibration of Measurement Channels and Measurement Reconstruction (Realizacja i badanie wybranych algorytmów wzorcowania torów pomiarowych oraz algorytmów odtwarzania mezurandów)

Roman Z. Morawski, Prof., D.Sc.,

A. Miękina, A. Podgórski;

01.04.95 - 31.03.96

- Review and systematization of methodological, mathematical and algorithmic fundamentals of calibra-

tion of measurement channels and measurands reconstruction;

- Summary of research concerning the application of numerical differentiation and the adjoint-operator methods with B-splines for dynamical measurand reconstruction;
- Study of the applicability of neural networks for quasi-static calibration of measurement channels (continued);
- Introductory study of wavelets applicability for dynamic measurand reconstruction;
- Implementation of selected algorithms of measurand reconstruction in a system for measuring radio-frequency (RF) signal and in an acoustic signal analyser;
- Implementation of selected algorithms of calibration in an acoustic signal analyser;
- Updating computer-system infrastructure dedicated to measuring system design.

[Pub22], [Pub38], [Pub79]; [Con5], [Con28], [Con64]

[Pro6] Some Investigations in Electromagnetic Metrology (Badania w dziedzinie metrologii wykorzystującej fale elektromagnetyczne)

Waldemar Kiełek, Assoc. Prof., D.Sc.,

K. Radecki, T. Buczkowski, K. Czerwiński;

01.04.95 - 31.03.96

- Investigations of the timing accuracy in scintillation counters and satellite laser pulse rangefinders using constant fraction discriminators;
- Monitoring system of components state in atomic frequency standard;
- Digital reflectometer elaboration for cable troubleshooting in LAN's;
- Improvement of gravitational geodetic measurements system using laser radiation.

[Pub17]

[Pro7] Problems and Methods of GSM Radio Equipment Measurement (Problemy i metody pomiaru urządzeń radiokomunikacyjnych systemu GSM)

Adam Fiok, Prof., D.Sc.,

J. Cichocki, J. Kołakowski, S. Żmudzin;

01.04.95 - 31.03.96

The project concerns technical aspects of the introduction of the GSM system in Poland. It was focused on recognition of problems connected with the testing of GSM mobile stations as well as instruments and facilities required for such inspection. The report includes a detailed review of commercially available instrumentation and evaluates the features and parameters required for the various tests (e.g. type approval, repair, diagnostic tests etc.). The analysis shows that there is a need for a laboratory equipped with facilities (e.g. anechoic chamber) and instrumentation for the testing of GSM equipment in Poland in spite of the high cost of the commercially available systems. Some equipment, especially EMC test facilities and instruments, can be used for testing other radiocommunication equipment.

[Pub106]

[Pro8] Remote controlled Free-field Electroacoustic Measurement System (System pomiarowy do zdalnych pomiarów elektroakustycznych w polu fali swobodnej)

Andrzej Leszczyński, Ph.D.,

M. Tajchert, J. Paluchowski, A. Aronowski;

01.04.95 - 31.03.96

The project covers:

- development of a system for remote electroacoustic measurement,
- investigation of acoustic properties of interiors using echograms,
- diagnostic measurement of the human hearing system,
- measurement of directional properties of loudspeakers and microphones using wide-band noise signals,
- project of sound recording studio.

[Rep8]

Projects granted by the Rector

[Pro9] **Design of Active and Switchable Microwave Circuits** (Projektowanie mikrofalowych układów przełączanych i aktywnych)

Tadeusz Morawski, Prof., D.Sc.,

J. Zborowska, W. Wojtasiak, M. Sypniewski,
D. Gryglewski, M. Lubiejewski;

01.08.95 - 01.06.96

Design methods for microwave linear amplifiers, VCO generators and switchable circuits with PIN diodes have been devised. Amplifiers for an L band VCO generator for an X-band synthesizer have been designed and measured. The results were presented and published in the National Conference on Telecommunication KST 96. [Rep 19]

[Pro10] **Three Dimensional Reconstruction Technique in Positron Tomography (PET)**. (Trójwymiarowa rekonstrukcja obrazów w tomografii pozytonowej PET - Positron Emission Tomography)

Marek Karolczak, Ph.D.;

01.08.95 - 01.06.96

The purpose of the work was the development and implementation of effective algorithms for 3D image reconstruction in positron tomography. New algorithm for PC Pentium computer (under LINUX operating system).

[Pro11] **Optimisation Methods for Full-wave High Frequency Synchronous Rectifiers** (Metody optymalizacji dwupołkowych prostowników synchronicznych wielkiej częstotliwości)

Mirosław Mikołajewski, Ph.D.;

01.08.95 - 01.06.96

Novel full-wave synchronous rectifiers with a transformer have been analysed and tested. In the new circuits regulating transistors operate in ZVS (zero-voltage-switching) or ZCS (zero-current-switching) mode, which enables high operating frequency and high efficiency to be achieved. The rectifiers were tested operating with single and dual regulating transistors at a frequency of 500 kHz. Output power was controlled throughout the full range (from zero to maximum).

[Rep12]

[Pro12] **Amplitude Modulation in Transistor Transmitters with Power Combining** (Modulacja amplitudy w tranzystorowych nadajnikach z sumowaniem mocy z wielu modułów)

Jan Ebert, Prof., D.Sc.,

J. Modzelewski, A. Owczarek;

01.08.95 - 01.06.96

A novel method of amplitude modulation in multi-module h.f. power transmitters has been invented, analysed and tested. The new method can be applied to digital amplitude modulation in h.f. transmitters with power combining. A laboratory model of the transmitter operating at the frequency of 500 kHz and maximum output power 450 W was built and tested. Its efficiency for maximum value of modulation index ($m=1$) was over 80%.

[Pub78]; [Rep7]

[Pro13] **Modern Measurement Strategy in Scientific Research and Engineering** (Współczesna strategia pomiaru w badaniach naukowych i inżynierii); a) Digital Processing of Measurement Signals in Environmental Monitoring, b) Methodology for Measuring Systems Design using Integrated Software Environments

Janusz Jaworski, Prof., D.Sc.,

a) Roman Z. Morawski, Prof., D.Sc.,

b) Wiesław Winięcki, Ph.D.;

16.05.95 - 31.05.96

a) The methods, algorithms and techniques of digital signal processing for measurement applications have been studied. The main objective of the study was to use them for correction of metrological parameters of sensors (especially: fiber-optic sensors and biosensors) as well as low-cost instruments and measuring systems (especially spectrophotometers), for monitoring the natural environment. The results of the study enabled their authors to successfully apply for a corresponding research grant from the State Committee for Scientific Research (KBN);

b) Influence of new CAD tools, named integrated software environments (ISE), for measuring system designing was analysed. A group of the newest ISE (e.g.: LabWindows/CVI, HP VEE, LabView) was described and compared. A multifunction stand for research and educational purposes was designed. A methodology for measuring system design using ISE was proposed. Virtual Instruments as a new kind of measuring equipment was discussed.

a) [Pub63], [Pub79]; [Rep10]; [Con4], [Con7], [Con11];

b) [Pub35], [Pub100]; [Con64]

Projects granted by the Dean

[Pro14] **Development of Computerized Techniques of Television Images Processing** (Rozwój komputerowych technik przetwarzania obrazów telewizyjnych)

Józef Modelski, Prof., D.Sc.,

A. Buchowicz, G. Siemek;

13.03.95 - 30.04.96

Many image processing techniques developed in recent years are used in modern television broadcast equipment. Especially important is the image compression and coding algorithm described in the MPEG-2 standard. The aim of this work was development of software simulating a MPEG compatible encoder and decoder. This software has been also used to test the effectiveness of the pre-processing techniques based on various nonlinear filters.

[Pro15] **Digital Signal Processing in a Cesium Beam Frequency Standard** (Cyfrowe przetwarzanie sygnałów w cezowym wzorcu częstotliwości)

Karol Radecki, Ph.D.,

W. Oszejca;

13.03.95 - 30.04.96

First and second harmonic of the modulating signal at the output of a cesium beam tube were measured during normal operation of the frequency standard and the shape of the atomic resonant line was calculated. A simple FFT spectrum analyser based on DSP56002 was constructed to analyse low frequency signals up to 40 kHz.

[Pro16] **Design of Microwave Circuits using Structural Optimization** (Projektowanie wybranych układów mikrofalowych z wykorzystaniem metod optymalizacji strukturalnej)

Wojciech Gwarek, Prof., D.Sc.,

A. Więckowski, P. Miazga, M. Celuch-Marcysiak, A. Kozak;

13.03.95 - 30.04.96

The objective of this project has been to investigate the possibilities of automatic design of microwave circuits using structural optimization combined with selected elements of electromagnetic field analysis. This is a novel approach in microwave technology. It should be stressed that the scientific experience of the individual members of the research group will be combined and coordinated towards practical applications.

The scope of the project covers three main issues:

- systematic review of algorithms for generating the topology of microwave circuits, based on zero- and one-dimensional models,
- elaboration and initial verification of algorithms for optimization of two-dimensional circuits,
- investigation of relationships between neural networks and electromagnetic simulators.

[Pro17] **Analysis and Design of Microwave Phase Shifters with FFT Transistors, PIN diodes and Varactors.** (Analiza i projektowanie mikrofalowych przesuwników fazy z tranzystorami FET oraz diodami PIN i warakto-rowymi)

Tadeusz Morawski, Prof., D.Sc.,

J. Zborowska, W. Wojtasiak, M. Sypniewski;

13.03.95 - 30.04.96

The research works devised out were concentrated in four subjects:

- Analysis and design of a phase-amplitude modulator with hybrid coupler and FET transistors;
- Design and measurement of a „loaded line” type binary with PIN diodes;
- Multiport reflectometers switched by PIN diodes;
- Analysis and design of phase shifters with couplers and varactors.

The results have been presented and published at four different conferences.

[Rep18];[Pub81], [Pub 94]

[Pro18] **A Method for Kidney Diagnosis Based on Tomography Dynamic Study.** (Metoda oceny stanu fizjologicznego nerki za pomocą tomograficznych badań dynamicznych)

Piotr Bogorodzki, M.Sc.,

A. Piątkowski, E. Piątkowska-Janko, J. Wasielewski;

13.03.95 - 30.04.96

A method for parametric mapping has been developed. This method converts a temporal series of images obtained in dynamic studies to single parametric image. The method was applied to kidney diagnosis.

[Pro19] **Clinical Software for Nuclear Medicine** (Oprogramowanie kliniczne dla potrzeb medycyny nuklearnej)

Piotr Brzeski, Ph.D.,

M. Karolczak, R. Szabatin, P. Błociszewski, T. Olszewski, D. Ćwiek, W. Smolik;

13.03.95 - 30.04.96

The aim of the work was to elaborate a clinical program for heart perfusion diagnostics. The program, dealing with planar scintigraphic tests, using MIBI radioactive agent is working in NMS environment, installed in over 25 hospitals in Poland.

[Pro20] **Optimalisation of Quality Measures for Lossy Compressed Medical Images.** (Optymalizacja miar jakości obrazów medycznych skompresowanych metodami stratnymi)

Marian Kazubek, Ph.D.,

A. Przelaskowski, T. Jamrógiwicz;

13.03.95 - 30.04.96

The blockiness effect measure as a part of hider objective image quality evaluation method was investigated. We elaborated and tested the algorithms which enable the block artifacts to be estimated better than other measures to date from literature.

[Pub59]

[Pro21] **Application of the Singular Value Decomposition Method for Improvement of ECG Signal Quality.** (Zastosowanie metod przekształceń przestrzeni wektorowych (OSVD, QSVD) do automatycznego wykrywania punktów charakterystycznych w przebiegach elektrokardiograficznych)

Krzysztof Zaremba, Ph.D.,

Z. Pawłowski, J. Marzec, B. Konarzewski;

13.03.95 - 30.04.96

New effective algorithms of noise suppression, based upon the Singular Value Decomposition (SVD) method, are proposed for simultaneous, adaptive filtration of all ECG leads.

[Pro22] **Application of New-generation DSPs in Instrumentation for Sound Measurement and Analysis** (Zastosowanie procesorów sygnałowych nowej generacji w aparaturze do pomiaru i analizy dźwięku)

Andrzej Podgórski, Ph.D.,

R. Z. Morawski, A. Miękina;

13.03.95 - 30.04.96

The rapid progress in the domain of diagnostic tests (esp. for machine condition monitoring), identification of acoustic sources and sound propagation paths poses new requirements towards measuring instrumentation. In many cases real-time advanced digital signal processing, performed in field conditions, is strongly required. Hand-held analysers operating in real-time seem to meet these requirements. During this project some of the metrological parameters of portable analysers constructed earlier were improved. It was done by the replacement of the Texas Instruments DSP chip (TMS 320C26 was replaced by TMS320C50) and the development of new data processing algorithms.

[Pub5], [Pub62]

[Pro23] **The Elaboration of a Method and a Computer Program for the Analysis of the Lossy Multi-**

layered Dielectric-ferrite Resonator for All Modes. (Opracowanie metody i programu komputerowego analizy wielowarstwowego stratnego rezonatora dielektryczno-ferrytowego dla wszystkich rodzajów drgań)

Krzysztof Derzakowski, Ph.D.;
13.03.95 - 30.04.96

The aim of the grant is the theoretical solution of the lossy multilayered dielectric-ferrite resonator problem for all modes as well as the development of a computer program for the analysis of this resonator elaborated on the base of this solution. The radial mode matching method as the most accurate for this purpose has been used for the theoretical solution of this resonator. The computer program enables the computation of all resonant frequencies and quality factors of the axisymmetric structures composed of many dielectric and ferrite layers with very high accuracy. A dielectric resonator figure of merit has been proposed for quality assessment of the dielectric resonators. A method for the identification of resonant modes has been also proposed. The work results also in two publications.

[Pub8], [Pub48]

[Pro24] **Laboratory Stand for the Investigation of Active Noise Control in a Duct.** (Układ laboratoryjny do badań aktywnej redukcji dźwięku w falowodzie)

Jerzy Narkiewicz-Jodko, Ph.D.,
M. Tajchert;
13.03.95 - 30.04.96

The project covers:

- analysis of a digital adaptive system for active sound control in a duct,
- description of FIR and IIR filters complementation using Motorola DSP6002 signal processor as a controller.

[Pro25] **Problems of the Evaluation of Radio Equipment Measurement Quality** (Problemy oceny jakości pomiaru urządzeń radioelektro-nicznych)

Adam Fiok, Prof., D.Sc.,
J. Cichoński, J. Kołakowski, S. Żmudzin;
13.03.95 - 30.04.96

The project concerns various aspects of the quality of measurement and the quality of systems intended for radiocommunication measurement. The report contains analysis concerning the identification of quality of technical objects and measurement of radio equipment. A proposed general approach to the quality evaluation of measuring metasystems has been elaborated. A definition of measurement quality has been proposed and a set of criteria for quality evaluation have been formulated. The validity of measurement results has been presented as one of the most important features of measurement.

[Pub57]

[Pro26] **The Application of Multidimensional Hilbert Transformation to Antenna Synthesis Technique** (Zastosowanie wielowymiarowej transformaty Hilberta w technice syntezy anten)

Jacek Jarkowski, Ph.D.,
K. Snopek, H. Chaciński, J. Chmielak;
13.03.95 - 30.04.96

The 3D analytic current distribution in an antenna cancels the radiation pattern in 7 quadrants, i.e. the radiation patterns exist only in 1 quadrant.

[Pro27] **Methodology for IEC-625 Measuring System Debugging and Testing** (Metodyka uruchamiania systemów pomiarowych z interfejsem IEC-625)

Wiesław Winięcki, Ph.D.,
K. Adamowicz, R. Leoniak, P. Sokołowski;
13.03.95 - 30.04.96

A methodology for the debugging and testing of measuring systems with IEC-625 interface was proposed. The methodology concerns debugging of hardware and software parts of systems. Basic sources of system faults were described. A simple device for the debugging and testing of measuring systems was designed. A set of a tester for research and development projects was build.

[Rep24]; [Pub70]

Priority grants

[Pro28] **Analysis and Investigation of Ultrasonic Links for Automation and Robotics** (Opracowanie i badania użytkowe ultradźwiękowych łącz powietrznych do zastosowań w automatyce i robotyce)

Jerzy Narkiewicz-Jodko, Ph.D.,
M. Baszun;
01.08.95 - 31.05.96

Design and testing of ultrasonic links for the purpose of remote measurement, control and position detection in automation and robotics

[Pro29] **Multimodality Analysis of Brain Images** (Analiza multimodalnych odwzorowań mózgu)

Roman Szabatin, Ph.D.;
13.03.95 - 30.04.96

Development and implementation of algorithms for the presentation of brain tomographic images is the main goal of this work. Three algorithms, *Surface Shadow*, *Volume Ray Tracing* and *Maximum Intensity Projection* are implemented for the presentation of medical tomographic images. Patients' raw data were obtained from the Warsaw Medical Academy Hospital.

[Pro30] **Studies of Lead Biokinetics** (Metody i aparatura do badań biokinetyki związków ołowiu w mózgu i tkance nerwowej)

Zdzisław Pawłowski, Prof., D.Sc.,
J. Marzec, K. Zaremba, B. Konarzewski;
13.03.95 - 30.04.96

A four-compartmental model of lead biokinetics in humans and laboratory animals has been developed. The model is expressed in terms of coupled first order differential equations. As opposed to the other existing models, penetration to the nervous tissue is included. The model parameters (lead movement rate) have been calculated using experimental data as well as the published data obtained in other laboratories. The proposed model was used to express some conclusions concerning methods of lead poisoning diagnosis.

[Pro31] **A New Contrast Agent Study for Brain and Vessel Imaging Purpose** (Badanie nowych środków kontrastowych w niskich polach do badania nad mózgiem i badań angiograficznych)

Adam Piątkowski, Prof., D.Sc.,
P. Bogorodzki, E. Piątkowska-Janko,
J. Wasielewski;
01.05.95 - 01.06.96

The main goal of this work was to develop a fast and stable method for brain perfusion mapping. The method converts a temporal series of images obtained in contrast aided tomographic dynamic study to single functional image.

- [Pro32] **Compound Method for Micropotentials Analysis in High Resolution ECG.**(Skojarzona metoda analizy mikropotencjałów w wysokorozdzielczej elektrokardiografii)
Ewa Piątkowska - Janko, M.Sc.,
 A. Piątkowski, P. Bogorodzki, J. Wasielewski;
 13.03.95 - 30.04.96

The aim of our study was to assess the optimal method for better patients discrimination between different groups using high resolution ECG.

- [Pro33] **The Compression of Echocardiography Image Sequences.** (Kompresja sekwencji obrazów echokardiograficznych)
Marian Kazubek, Ph.D.,
 A. Przelaskowski, T. Jamrógiewicz,
 J. Mirkowski;
 13.03.95 - 30.04.96

We investigated a method of reducing the bit-rate, required to transmit the echocardiography image sequence for telediagnosis. The standard solutions compatible with MPEG were applied. We investigated and optimised the modules of estimation and compensation based on the characteristics of real sequences. The results clearly show that using small optimal motion vectors search areas and simple prediction and interpolation models are the most profitable. We estimated the most effective composition scheme for predicted and interpolated frames. The application of interframe coding techniques with proper motion estimation and compensation can improve the echocardiography image sequence compression efficiency by about 50% related to intraframe compression.

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

- [Pro34] **Application of Median Filters to Real-time Video Signal Processing.** (Zastosowanie filtrów medianowych do przetwarzania sygnału wizyjnego w czasie rzeczywistym)
Józef Modelski, Prof., D.Sc.,
 A. Buchowicz, M. Celuch-Marcysiak,
 W. Gwarek, B. Jakubowski, J. Kondarewicz,
 G. Siemek, W. Skarbek, T. Smakuszewski,
 A. Smoliński;
 01.02.94 - 30.12.96

The aim of this work was to design, test and implement in hardware multistage median filters. These filters are expected to be used in real-time video signal processing, e.g. for noise removing. The multistage median filters have been built with the use of "Altera" programmable logic circuits. The algorithms for motion detection, color image processing and criteria for image quality comparison have also been studied in this work.

[Pub41]

- [Pro35] **In-Phase Array Antenna** (Ścianowa synfazowa antena radiolokacyjna)
Stanisław Rosłonec, Prof., D.Sc.;
 04.94 - 03.96

An in-phase array antenna has been a main subject of the research work. This work includes synthesis of antenna current distributions for given radiation patterns and designing the multi-channel in-phase power dividers/combiners. Outputs of these dividers are terminated with broadband radiating elements. Obtained results have been implemented in practice.

[Pub28], [Pub30]

- [Pro36] **Digital Filtering for High-resolution ECG** (Filtry cyfrowe do analizy EKG wysokiej rozdzielczości)
Ewa Piątkowska-Janko, M.Sc.,
 A. Piątkowski, P. Bogorodzki, J. Wasielewski;
 01.05.94 - 30.06.96

The aim of our study was to verifying the "compound" method of patients identification (the method which was described in our earlier grant no. 8-0458-91-01). We applied our compound method of signal averaged ECG (SAECG) analysis for identification patients(pts) with sustained ventricular tachycardia(sVT) after myocardial infarction (MI) and right or left bundle branch block (RBBB or LBBB). We studied 190 pts and concluded that our new method of analysis of SAECG - with new parameters of vector magnitude QRS, enables good separation of pts, and about 90% correct decisions. After analysis of 376 pts from three groups: pts with sVT after MI, pts without sVT after MI, and a control group we concluded that this new compound method gives a high percent of correct decisions and good separation of pts from different groups.

[Rep23]

- [Pro37] **Triggering Technique of MR Tomography with ECG and Respiratory Signals.** (Opracowanie metody synchronizacji tomografu rezonansu magnetycznego sygnałami z układu oddechowego i krążeniowego)
Adam Piątkowski, Prof., D.Sc.,
 P. Bogorodzki, E. Piątkowska-Janko,
 J. Wasielewski;
 01.07.94 - 30.06.96

The majority of "semi" real-time imaging methods allowing organ motion analysis, are based on triggered scanning protocols. This approach requires additional hardware and software in order to evaluate organ motion phases from measured ECG and respiratory signals. Triggering techniques are widely accepted in different imaging methods including ultrafast MRI and CT. In this work we described methods and instruments for respiratory signal gating and triggering. This subjects covers: respiratory signal measuring methods in the presence of high electromagnetic fields (in MR Tomography), respiratory signal segmentation methods be able to run in real time, implementation of segmentation procedures on signal processor.

[Pub40]; [Rep22]

- [Pro38] **Multidimensional Complex Signals, Further Theoretical Developments, Analysis of the Possible Applications** (Wielowymiarowe sygnały zespolone, dalszy rozwój teorii oraz zbadanie możliwości i celowości zastosowań)
Stefan Hahn, Prof., D.Sc.,
 J. Jarkowski, A. Buchowicz;
 01.07.94 - 30.06.97

The extension of the well known 1-D analytical signal to the case of 2-D and multidimensional signals is being studied in this project. The algorithms for the decomposi-

tion of the 2-D signal into amplitude and phase components, energy relations, theory of the multidimensional delta distribution and application of the multidimensional complex signal in antenna designing are also analyzed. [Pub40], [Pub41]

[Pro39] **Methodology and Apparatus for In Vivo Bone and Toxic Metal Concentrations in Bones Measurement.** (Metodyka i aparatura do nieinwazyjnych badań gęstości tkanek kostnych i stężeń ciężkich metali toksycznych w kościach)
Zdzisław Pawłowski, Prof., D.Sc.,
J. Marzec, K. Zaremba, B. Konarzewski;
01.04.95 - 15.12.97

Three methods have been studied and optimized. Bone density has been measured by radiophotodesitometry (RD) and coherent to Compton scattering ratio (CCSR) method. Toxic metal concentrations have been determined by X-ray fluorescence analysis. Special apparatus has been constructed to facilitate these measurements.

[Pro40] **Application of Singular Value Decomposition Method for Automatic Detection of ECG Characteristic Points.** (Zastosowanie metod przekształceń przestrzeni wektorowych (OSVD, QSVD) do poprawy wartości diagnostycznej przebiegów elektrokardiograficznych)
Krzysztof Zaremba, Ph.D.,
J. Marzec, B. Konarzewski;
01.07.95 - 30.06.97

New methods of effective automatic ECG characteristic points detection are proposed. The methods are based upon Singular Value Decomposition (SVD) method and one of the SVD generalisations, called Generalised or Quotient SVD.

[Pro41] **Multimode Dielectric Resonator Filters** (Wielorodzajowe filtry z rezonatorami dielektrycznymi)
Sławomir Białas, M.Sc.;
01.07.95 - 01.12.96

The analysis and design of microwave dual- and tripple-mode elliptic-type filters with dielectric resonators have been presented. The new method for determination of coupling coefficient between resonators and transmission lines (e.g. microstrip) as well as electric and magnetic loops has been developed. The example of such filter has been built.

[Pro42] **Novel Circuits of DC/DC Resonant Converters with Synchronous Rectifiers** (Nowe rozwiązania rezonansowych przetwornic napięcia stałego z prostownikami synchronicznymi)
Mirosław Mikołajewski, Ph.D.,
J. Ebert, J. Modzelewski, K. Radecki, K. Puczko, A. Owczarek;
01.03.95 - 28.02.96

The purpose of the research project was to design and test experimentally novel resonant, high-efficiency, high- and constant-frequency dc/dc converters with a high output current capability and a wide range of output power regulation. As a result of the project novel synchronous rectifiers with a transformer have been invented, theoretically analysed and tested experimentally. Design procedures for dc/dc converters with a synchronous rectifier and Class D and Class E amplifiers have been given. Experimental dc/dc converters with the new rectifiers and the Class D amplifier (converter output

power 240 W, output voltage 12 V, efficiency 89%) as well as the Class E amplifier (converter output power 50 W, output voltage 5 V, efficiency 82%) were designed and tested. The operating frequency of the converters was constant and equal to approx. 1 MHz.
[Pub76]; [Rep6]

[Pro43] **Multimodal Imaging in Medical Topographic, Tomographic and Functional Studies** (Multimodalne obrazowanie badań topograficznych, tomograficznych i czynnościowych w medycynie)
Piotr Brzeski, Ph.D.,
M. Kazubek;
01.09.95 - 28.02.97

The main aim of the project is to elaborate the metrology of joint presentation of images acquired from different modalities. Images have to be matched to each other, so that effective algorithms for magnification, rotation and shift must be elaborated. So called complementary studies are of special interest. These are SPECT (PET) images with functional information together with MRI (CT) images with excellent spatial resolution.

[Pro44] **The Use of Variational Algorithms of Deconvolution for Processing Spectrophotometric Data** (Zastosowanie wariacyjnych algorytmów odtwarzania mezurandów do poprawy dokładności analiz spektrometrycznych).
Roman Z. Morawski, Prof., D.Sc.,
A. Miękina;
01.01.96 - 31.12.96

A new methodology for processing spectrophotometric data has been worked out. It includes:

- the use of variational algorithm of deconvolution for determining an initial estimate of the ideal spectrogram on the basis of measurement data;
- estimation of the position of spectrometric peaks on the basis of the initial estimate of the spectrogram;
- the use of the optimal curve-fitting algorithms for estimation of the magnitudes of peaks on the basis of measurement data and estimates of the positions of peaks;
- iterative correction of the estimates of positions and magnitudes of peaks.

[Pub21], [Pub80]

[Pro45] **Novel Methods of Output Power Control in High-efficiency High-frequency Power Amplifiers and Generators.** (Nowe metody regulacji mocy wyjściowej w wysokosprawnych wzmacniaczach i generatorach mocy wielkiej częstotliwości)
Jan Ebert, Prof., D.Sc.,
M. Mikołajewski, J. Modzelewski, K. Puczko, K. Radecki;
02.01.96 - 31.12.96

Two novel methods of output power control in high-efficiency high-frequency power amplifiers and generators have been proposed, analysed and experimentally tested. One of the methods utilises synchronous regulators and the other one combines output power from multiple amplifiers. Laboratory tests with Class E and Class D amplifiers operating at the constant frequencies 0.5 MHz and 1MHz have demonstrated that both methods enable the achievement of high efficiency (up to 96%), high output power (up to 700 W) and a wide range of

output power control in h.f. resonant power amplifiers. [Con43]; [Pub75]

[Pro46] **The Matched MRI and SPECT Method for Investigation of the Neuro System.** (Skojarzona metoda badania ośrodkowego układu nerwowego z zastosowaniem techniki magnetycznego rezonansu (MR) i tomografii izotopowej jednofotonowej (SPECT))

Roman Szabatin, m Ph.D.,

T. Pałko, L. Królicki;

01.08.96 - 31.07.98

Image registration and fusion of the same patient investigated by MRI and SECT is a very effective method for the diagnosis of brain diseases such as: epilepsy, brain infarct, tumor metastasis. Development of a computer system for the evaluation of multimodality images is the main purpose of this work.

[Pro47] **The Algorithms for Correction of Metrological Characteristics of Measurement Instrumentation Applied in Environmental Monitoring** (Algorytmy poprawiania charakterystyk metrologicznych aparatury pomiarowej stosowanej w monitoringu środowiska naturalnego)

Roman Z. Morawski, Prof., D.Sc.,

A. Podgórski, A. Miękina, P. Kluk;

08.07.96 - 01.06.99

The methods, algorithms and techniques of digital signal processing for measurement applications are studied. The main objective of the study is to use them for correction of metrological characteristics of sensors and instruments applied in the monitoring of the natural environment. Two problems are of particular importance:

- the use of a-priori information on the quantities to be measured (measurands), measurement channel and errors in the data for designing advanced algorithms for measurand reconstruction and algorithms for the calibration of measurement channels;
- the application of these algorithms for improving the metrological characteristics of a low-cost spectrophotometer for mass application in the monitoring of the natural environment.

[Pro48] **MRI of Heart and Large Vessels - imaging Sequence Optimization** (Analiza metod obrazowania MR dla uzyskania optymalnej rozdzielczości kontrastowej w badaniach serca i dużych naczyń)

Piotr Bogorodzki, M.Sc.,

A. Piątkowski, E. Piątkowska-Janko,

J. Wasielewski;

01.11.96 - 30.04.99

The aim of the project is to optimize imaging sequence in order to obtain contrast resolution for cardiac and vessel imaging.

[Pro49] **Design and Technological Realization of Transmission/Reception Module** (Technika mikrofalowa dla potrzeb radiolokacji)

Tadeusz Morawski, Prof., D.Sc.,

W. Wojtasiak, J. Zborowska, D. Gryglewski;

01.07.95 - 01.11.96

Telecommunications Research Institute (KBN), Warsaw
The transmission/reception module TRM for active phased array radar consists of three fundamental functional blocks: transmit block, receive and control circuit block, diagnostics and power supply block. The designed

and technologically constructed TRM device includes a three-step pulsed microwave linear power amplifier, ferrite circulator, microwave switches, low noise reception amplifier, buffer amplifier, power supply and diagnostic/control circuits. The output power of the transmitter is not less than 15W in L band. 30dB gain in transmission amplifier and 23dB gain in reception amplifier with isolation 38dB between transmission and reception part were obtained.

[Pub103], [Pub104]; [Rep15], [Rep16], [Rep17]

[Pro50] **Computer-Aided Design of Algorithms for the Digital Processing of Measuring Signals** (System wspomagania projektowania algorytmów przetwarzania sygnałów pomiarowych)

Roman Z. Morawski, Prof., D.Sc.,

A. Kalinowska, P. Kluk, A. Miękina A. Podgórski,

P. Sokółowski;

01.07.93 - 30.06.96

The SCR-Ver.2.0/PC software system has been devised using, a Matlab 4.2 environment. It is dedicated to the computer-aided design of algorithms for the digital processing of measurement signals. Its architecture and library contents are based on 15-years of research experience in the domain of the design and analysis of algorithms for the reconstruction of measurands and calibration of measurement channels, especially those applied in chemometrics and sensor technology. The main functions of the SCR-Ver.2.0/PC system are the following:

- simulation of measurement data using linear dynamic and nonlinear static models of measurement channels (with one influence quantity),
- dynamic and static calibration of measurement channels,
- dynamic and static reconstruction of measurands,
- visualization of the processed measurement signals,
- control of the analysis of calibration and reconstruction algorithms, using both synthetic and real-word data.

[MSc16]; [Pub74], [Pub81], [Pub63], [Pub21]; [Rep11];

[Con11], [Con42], [Con64]

[Pro51] **Novel Methods of Output Power Control in High-efficiency High-frequency Power Amplifiers and Generators** (Nowe metody regulacji mocy wyjściowej w wysokosprawnych wzmacniaczach i generatorach mocy wielkiej częstotliwości)

Jan Ebert, Prof., D.Sc.,

M. Mikołajewski, J. Modzelewski, A. Owczarek,

K. Puczko, K. Radecki;

02.01.96 - 31.12.96

During the project the following research tasks were performed:

- analysis, and optimisation of novel circuits combining power from dynamically switched h.f. zero-voltage-switching Class D amplifiers,
- building and testing of a laboratory model of power combining circuits operating at a constant frequency of 500 kHz and delivering 500 W of output power,
- analysis and optimisation of novel h.f. synchronous regulators,
- building and testing of dc/dc and dc/ac 50 W power converters,
- with synchronous regulators and Class E amplifiers operating at 1MHz.

[Pat3]; [Con43]; [Pub75], [Pub77]

4.3. Other projects

[Pro52] **Development of a Radiomonitoring System** (Opracowanie systemu radiomonitoringowego)
Stanisław Żmudzin, M.Sc.,
 A. Fiok, J. Cichoński, J. Kotakowski;
 01.11.94 - 01.04.96
 Fund by National Radiocommunication Agency
 PAR (Zarząd Krajowy Państwowej Agencji Radiokomunikacyjnej PAR)

The aim of the project was to work out a radiomonitoring system intended for monitoring the electromagnetic environment in radio frequency band. The system allows for measurement and analysis of typical radio emission parameters e.g. frequency, signal levels, channel occupancy, profile compliance etc. The system is equipped with the following standard radioelectronic measuring devices: spectrum analyser, radiocommunication receiver, audio recorder, switching unit, instruments for geographic position determination (GPS, compass) and auxiliary equipment (antenna rotors, DC/AC converters etc.). The project covered general design and development of the software (Windows based applications) and commercially unavailable instruments (i.e. switching units, dc/ac converters). A prototype of the system has been built, installed in a van and successfully tested.

[Pro53] **Automation of a Gigatune-18 PAR Broadcasting Signal Acquisition System** (Automatyzacja systemu odbiorczego Gigatune-18 PAR)
Konrad Adamowicz, Ph.D., Wiesław Winiński, Ph.D.,
 R. Leoniak, P. Sokołowski;
 25.01.94 - 29.06.96
 Fund by National Radiocommunication Agency
 PAR (Zarząd Krajowy Państwowej Agencji Radiokomunikacyjnej PAR)

The main purpose of this project was the automation of channel occupation monitoring and signal parameter checking in the frequency range 10kHz-18GHz with a capability of storing a large amount of data. For these purposes a broadband monitoring system has been designed and tested. The signals are picked up by a set of selective antennae and fed to the appropriate receivers through a broadband computer-controlled switch. The whole system is computer controlled to make possible radiocommunication instruments programming and data acquisition as well as timing of measurements and data storage. The system performs over 130 different measurement algorithms: from single frequency, frequency range and frequency list algorithms to a complicated list of numerous timer controlled tasks. The system was designed using LabWindows/CVI.
 [Rep1], [Rep2]; [Pub37], [Pub38]

[Pro54] **Modernization of a Series of AP1-1 Automatic Control Units and Preparing them for Final Tests** (Wykonanie modernizacji i przygotowanie do prób końcowych serii zespołów automatycznego sterowania AP1-1)
Kowalski Krzysztof, Ph. D.
 H. Chaciński, K. Robaczyński, W. Kazubski
 1995-1996

The project was developed in cooperation with the Military Technical Institute of Weapons
 High reliability electronic circuits were developed and used in these automatic control units. Due to this mod-

ernization an essential increase in control unit reliability was obtained.

[Pro55] **A Measurement System for Monitoring High Frequency Field Levels.** (Opracowanie projektu urządzenia do kontroli natężenia pola w.cz.)
Jacek Jarkowski, Ph.D.;
 01.03.1996 - 30.07.1996
 Fund by Polish Telecommunicationb S.A. - Radiocommunication and Telecommunication Center (TP SA Centrum Radiokomunikacji i Telekomunikacji)

The development of concept of a measurement system for monitoring the field level around the long wave broadcasting antenna in Konstancinów to counter neighbourhood residents' fears about high frequency fields.

[Pro56] **Analysis of the Possibility of Applying Digital Modulation to 150 kHz - 30 MHz Frequency Range Broadcasting.** (Analiza możliwości wykorzystania zakresu częstotliwości 150kHz-30MHz dla potrzeb radiofonii cyfrowej)
Jacek Jarkowski, Ph.D.,
 T. Kosiło;
 01.05.96 - 01.03.98
 National Radiocommunication Agency PAR
 (Państwowa Agencja Radiokomunikacyjna PAR)

The main aim of this work is to create a theoretical basis for the transmission, to form system requirements and to study the possibility of additional data transfer in digital transmission system channels in the frequency range of 150 kHz - 30 MHz.

[Pro57] **Development and Application of a Computer Set Extending the Capabilities of a Station for Testing Automatic Control Units** (Opracowanie i wdrożenie modelu użytkowego stanowiska komputerowego rozszerzającego możliwości stacji KIPS - 2W8E)
Kowalski Krzysztof, Ph. D.,
 H. Chaciński, K. Robaczyński, W. Kazubski;
 1995 - 1996
 Project developed in cooperation with the Weapons Military Technical Institute.

A computer set extending the capabilities of a standard station for testing automatic control units was developed. The main capabilities of this set are:

- automatic testing of successive control unit circuits according to programmed procedures,
- simultaneous testing and display of various control unit parameters,
- precise and quick adjustment of control units,
- identification of damages in control units.

[Pro58] **Elaboration and Realisation of an L-band Amplifier for Noise Signals** (Opracowanie i wykonanie przedwzmacniacza sygnału szumowego na pasmo L)
Wojciech Wojtasiak, M.Sc.,
 T. Morawski, D. Gryglewski, M. Lubiejewski;
 01.05.96 - 01.08.96
 Fund by Military Technical Institute of Weapons,
 Zielonka/Warsaw

Noise from an NC513/15 type generator is amplified in a super-linear L-band transistor amplifier and filtered by a band-pass filter with band - width of 170MHz. The slope of the insertion loss characteristic is equal to 0.5dB/MHz

over the band. The output-power of the designed amplifier is regulated from 0.15mW to 15mW. Maximum gain is equal to 55dB.

[Pro59] **Realisation of Measuring Equipment for Mobile Radiomonitoring Stations** (Wykonanie urządzeń pomiarowych do ruchomych stacji radiomonitoringowych)

Stanisław Żmudzin, M.Sc.,

J. Cichoński, J. Kołakowski;

15.05.96 - 31.03.97

Fund by National Radiocommunication Agency PAR (Zarząd Krajowy Państwowej Agencji Radiokomunikacyjnej ZK PAR)

The project is a continuation of the previous work on radiomonitoring stations. Its aim is the manufacture of unique equipment for several mobile radiomonitoring stations. The work covers the design and development of new computerised switching units which permit: the selection of signals coming from various antennae, their amplification and delivery to measuring instruments. It also concerns design and manufacture of appropriate PC cards intended for switches and audio recorder control and microprocessor based interfaces enabling computer control of antenna rotors. The project included implementation of necessary modifications for commercially available dc/ac converters as well as preparation of detailed specifications for mounting the radiomonitoring systems in vans.

[Pro60] **Elaboration of a New Version of Radiomonitoring System Software and Analysis of the Extension of Mobile Radiomonitoring Station Capabilities** (Opracowanie nowej wersji oprogramowania systemu SMS i analiza dotycząca rozbudowy ruchomych stacji pomiarowych)

Stanisław Żmudzin, M.Sc.,

J. Cichoński, J. Kołakowski;

02.09.96 - 20.06.97

National Radiocommunication Agency PAR (Zarząd Krajowy Państwowej Agencji Radiokomunikacyjnej PAR)

The project undertakes the further development of existing radiomonitoring stations. The extensions cover two main areas: improvement of the software and preparation of a station for making measurements when driving. The new, 32-bit, version of software takes advantage of the new capabilities of the Windows 95 environment. It provides a new, enhanced user interface which makes the programming measuring process easier (property sheet and wizard windows, trees, tab controls etc.). The program is now multithreaded application which assures its more effective a execution. The second area of the project covers research on system mobility. It includes: analysis and choice of appropriate antennae and new types of radiocommunication receiver, modifications necessary for geographic position determination in urban areas and measurement aspects connected with the extension of the system's frequency range up to 18 GHz.

[Pro61] **Possibilities of Introducing the GSM-R in Poland** (Możliwości wdrożenia systemu GSM na PKP)

J.Modelski, Prof., D.Sc.,

T. Kosiło, K. Radecki;

09.08.96 - 15.10.96

Fund by Central Research Laboratory of the Polish Railways (PKP - Centrum Naukowo-Techniczne Kolejnictwa)

The parameters of the UIC-GSM-R digital radio standard for European railways were analysed, taking into consideration specific Polish Railways conditions. In particular the following services, railway specific applications and features were analysed: broadcast and group call services, exchange of address and location information between train and ground, interpretation of short messages, confirmation of high priority calls, shunting radio, cab radio, man machine and other interfaces, environmental specifications, controller position functional specifications, system configuration (numbering plans, priority levels, subscription, closed user groups).

[Pro62] **Autonomic Testing and Verification of Automatic Control Units AP-1** (Przeprowadzenie badań i usprawnień siedmiu zespołów AP-1)

Kowalski Krzysztof, Ph. D.,

H. Chaciński, K. Robaczyński, W. Kazubski;

02.09.96 - 30.09.96

Project developed in cooperation with the Military Technical Institute of Weapons

A method of precise autonomic testing and verification of AP-1 automatic control units was developed. This method permits the verification and adjustment of automatic control units before firing.

[Pro63] **Elaboration and Realisation of an L-band Microwave Power Amplifier** (Opracowanie i wykonanie wzmacniacza mocy na pasmo L)

Wojciech Wojtasiak, M.Sc.,

T. Morawski, J. Zborowska, D. Gryglewski,

M. Lubiejewski;

01.10.96 - 01.11.96

Fund by The Military Technical Institute of Weapons

Designed A - Class, L-band amplifier is characterised by its very linear output/input characteristic. Its gain, more than 40dB and output power 10dB is obtained due to application of an integrated MSA1104 amplifier and a two-step amplifier using Ga-As MESFET transistors (Fujitsu and NEC).

[Pro64] **Elaboration and Realisation of an S-band Amplifier for Noise Signals** (Opracowanie i wykonanie przedwzmacniacza sygnału szumowego na pasmo S)

Wojciech Wojtasiak, M.Sc.,

T. Morawski, D. Gryglewski, M. Lubiejewski;

01.10.96 - 15.12.96

Fund by The Military Technical Institute of Weapons

Noise signals from an NC513/15 type generator are amplified in a super-linear S-band transistor amplifier and filtered by a band-pass filter with band - width of 170MHz. The slope of the insertion loss characteristic is equal to 0.5dB/MHz over the band. The output-power of the designed amplifier is regulated from 0.15mW to 15mW. Maximum gain is equal to 55dB.

[Pro65] **Elaboration Realisation of an X-band Microwave Synthesizer** (Opracowanie i wykonanie syntezy częstotliwości na pasmo X)

Wojciech Wojtasiak, M.Sc.,

T. Morawski, D. Gryglewski, M. Lubiejewski;

01.08.96 - 01.12.96

Fund by Military Academy of Technology, Warsaw

The synthesizer X-band designed is digitally controlled, the frequency step is equal to 10MHz in 600MHz broad frequency band. For the technological realisation of the synthesizer a quartz - generator GWM5-1 with stability 10^{-7} , a digital phase locking loop QUALCOMM Q 3036 and designed VCO - generator with separator were used. The obtained output power is equal to $12\text{mW} \pm 10\%$.

[Pro66] **Requirements for the Railway CCTV Systems** (Wymagania na systemy telewizji przemysłowej dla potrzeb prowadzenia ruchu pociągów)

Józef Modelski, Prof., D.Sc.,

A. Buchowicz, J. Kondarewicz, J. Kosnik, J. Marzyjanek, M. Pietraszek;
01.12.96 - 31.12.96

Fund by Central Research Laboratory of Polish Railways (PKP - Centrum Naukowo-Techniczne Kolejnictwa)

The aim of this work was to establish a set of requirements for the CCTV systems which will be installed by Polish Railways. The possibilities of new applications for

the CCTV systems have been analyzed. The integration of the CCTV systems with a computer database containing information about trains has been proposed.

[Pro67] **Technical and Exploitation Aspects of GSM-R Introduction in Polish Railways Lines**

(Analiza techniczno-eksploatacyjna wdrożenia systemu GSM-R na liniach kolejowych PKP)

J. Modelski, Prof., D.Sc.,

T. Kosiło, K. Radecki;
25.11.96 -20.12.96

Fund by Central Research Laboratory of the Polish Railways

Several aspects of the GSM-R introduction in Polish Railways were discussed: selection of railway network services, problems of ETCS data transfer, possibilities of system configuration, requirements for radio interfaces, estimation of frequency requirements in the 900 MHz band for the traffic in the region of Górny Śląsk, principles of cooperation between GSM-R and PKP radio communication systems.

5. DEGREES AWARDED

5.1. Ph.D. Degrees

- [PhD1] Małgorzata Celuch-Marcysiak: "A Generalized Approach to FDTD and TLM Algorithms Applied to Microwave Circuit Modelling", Prof. W. Gwarek (tutor), Warsaw 1996 (honors).
- [PhD2] Maciej Sypniewski: "Wielowrotowe przełączane reflektometry mikrofalowe" (Multiport Multi-state Microwave Reflectometers), Prof. T. Morawski (tutor), Warsaw 1996.

5.2. M.Sc. Degrees

- [MSc1] Fathi Alwafi: "Symulator modulatora GMSK" (Simulator of GMSK Modulation), Assist. Prof. T. Kosiło (tutor), (4)
- [MSc2] Dariusz Bednarczyk: "Elektronicznie sterowany filtr antenowy" (Electrically Switchable Microwave Filter), Prof. S. Rosłonec (tutor), (5)
- [MSc3] Grzegorz Białas: "Zakresy synchronizacji pętli PLL drugiego rzędu" (Synchronisation Ranges of 2-order PLL Loop, Assist. Prof. J. Jarkowski (tutor), (3,5)
- [MSc4] Piotr Błażewicz: "Rekonstrukcja powierzchni obiektów trójwymiarowych w oparciu o przekroje tomograficzne oraz o prezentacje 3D" (3D Object Surface Reconstruction Based on Tomographic Slices), Assist. Prof. M. Kazubek (tutor), (5)
- [MSc5] Grzegorz Borowski: "Depolaryzator polaryzacji kołowych dla stacji czołowej telewizji kablowej" (Circular Polarization Transformer for Cable Television Main Stations), Prof. J. Modelski (tutor), (3,5)

- [MSc6] Sławomir Boryczka: "Analiza wykorzystania sztucznych sieci neuronowych do rekonstrukcji obrazów w tomografii impedancyjnej" (Analysis of Artificial Neural Networks Utilization for Imaging Reconstruction in Impedance Tomography), Assist. Prof. J. Mirkowski (tutor), (5)
- [MSc7] Jarosław Borysewicz: "Zastosowanie funkcji typu dzwonowego o skończonym nośniku do statycznego wzorcowania torów pomiarowych" (Application of B-spline for the Static Calibration of Measurement Channels), Assist. Prof. A. Podgórski (tutor), (3,5)
- [MSc8] Grzegorz Bryzek: "Systemy ekspertowe wykorzystujące graf konwersacyjny" (Expert Systems with Conversation Graph), Assist. Prof. J. Chudziak (tutor), (5)
- [MSc9] Grzegorz Chorzewski: "Spektrometryczny procesor sygnałowy" (Spectrometric Signal Processor), Assist. Prof. W. Cudny (tutor), (5)
- [MSc10] Piotr Czyżewski: "Teoretyczne i praktyczne aspekty kontroli jakości oprogramowania" (Theoretical and Practical Aspects of Software Quality Control), Assist. Prof. M. Karolczak (tutor),
- [MSc11] Piotr Filipiuk: "System akwizycji danych z gammakamery" (Data Acquisition System for Gammacamera), Assist. Prof. M. Karolczak (tutor), (5+, honor)
- [MSc12] Norbert Góra: "Układ akwizycji systemów pozycyjnych z kamery gamma" (Data Acquisition System for Gammacamera), Assist. Prof. M. Karolczak (tutor), (5)
- [MSc13] Daniel Gryglewski: "Generator VCO do syntezy na pasmo X" (VCO Generator for X-band Synthesizer), Prof. T. Morawski / Assist. W. Wojtasiak (tutors), (5)

- [MSc14] Artur Halarewicz: "*Frame grabber jako karta do PC służący do archiwizacji badań USG*" (Frame Grabber for USG Sequence Acquisition), Assist. Prof. M. Kazubek (tutor), (4)
- [MSc15] Robert Jacoszek: "*Dekoder systemu identyfikacji programów telewizyjnych programowany danymi z teletekstu*" (VPS Decoder Programmable by Means of Teletext Data), Assist. Prof. Z. Kozłowski (tutor), (5)
- [MSc16] Mirosław Januszek: "*Aparat EKG do elektrokardiografii wysokiej rozdzielczości*" (High Resolution Electrocardiograph), Assist. Prof. J. Marzec (tutor), (5)
- [MSc17] Wojciech Kasznia: "*Technika korekcji niejednorodności pola magnetycznego w tomografii MR metodą harmonicznych sferycznych*" (A Spherical Harmonics Approach to Field Homogeneity in MR Tomograph), Prof. A. Piątkowski (tutor), (4)
- [MSc18] Krzysztof Kieniewicz: "*Koncepcja i realizacja uniwersalnej części sterującej mikroprocesorowego urządzenia pomiarowego z interfejsem IEC-625.2*" (Microprocessor Control Unit for IEC-625.2 Measurement Devices), Assist. Prof. W. Winiecki (tutor), (5)
- [MSc19] Krzysztof Kowalczyk: "*Cyfrowy miernik czstotliwości jako element systemu pomiarowego*" (Digital Frequency Meter as an Element of a Measuring System), Assist. Prof. K. Adamowicz (tutor), (4)
- [MSc20] Paweł Kowalski: "*Analiza wpływu pomiarów i algorytmów rekonstrukcji na jakość uzyskanych obrazów w tomografii impedancyjnej*" (Analysis of the Influence of Measurement and Reconstruction Algorithms on Quality Imaging in Impedance Tomography), Assist. Prof. J. Mirkowski (tutor), (5)
- [MSc21] Adam Krajewski: "*Wave-Lab - program komputerowy do wspomaganie pomiarów akustycznych*" (Wave-Lab - Computer-aided Electroacoustic Measurement System), Assist. Prof. A. Leszczyński / Assist. J. Paluchowski (tutors), (4)
- [MSc22] Władysław Krasiejko: "*Cyfrowe metody filtracji elektrokardiogramu i detekcji punktów charakterystycznych*" (Digital Methods of ECG Filtration and Characteristic Point Detection), Assist. Prof. K. Zaremba (tutor), (5+, honor)
- [MSc23] Krzysztof Krawczyk: "*Cyfrowy miernik przesunięcia fazy*" (Digital Phasemeter), Assist. Prof. K. Adamowicz (tutor), (5)
- [MSc24] Tomasz Wojciech Kucharski: "*Język parametrycznego opisu struktur przestrzennych i jego interpreter dla trójwymiarowego edytora graficznego*" (3-D Structures Description Language and its Interpreter for Graphical Editors), Assist. Prof. A. Więckowski (tutor), (4)
- [MSc25] Piotr Kuczmański: "*Uniwersalny modułowy rejestrator dyskowy*" (Universal Modulator FFD Auto Recorder), Assist. Prof. A. Więckowski (tutor), (3.5)
- [MSc26] Krzysztof Kurek: "*Automatyczna korekcja wpływu temperatury na tłumienie i dyspersję przewodnic współosiowych w sieciach telewizji przewodowej*" (Automatic Correction of Temperature Influence on Attenuation and Dispersion of Coaxial Lines for Cable Television Networks), Prof. J. Modelski (tutor), (5+, honor)
- [MSc27] Dariusz Lis: "*Projektowanie i realizacja projektu ośrodka telewizyjnego Ogólnopolskiego Centrum Edukacji Niestacjonarnej w Warszawie*" (Design and Development of a Project for the Polish Centre for Extramural Education in Warsaw), Prof. J. Modelski (tutor), (3.5)
- [MSc28] Maciej Markiewicz: "*Kalibracja przełączanego reflektometru czterowrotowego na pasmo 4-400 MHz*" (Calibration of Switched Four-port Reflectometer on 4-400 MHz Band), Assist. M. Sypniewski (tutor), (3.5)
- [MSc29] Jacek Marzyjanek: "*Układ wyświetlania daty i czasu w obrazie TV - część cyfrowa układu*" (Device for Displaying Date and Time on TV Screen), Assist. Prof. Z. Kozłowski (tutor), (5+, honor)
- [MSc30] Jacek Nowacki: "*Implementacja sztucznych sieci neuronowych w programie do kompresji i klasyfikacji danych z holterowskiego badania EKG*" (Implementation of Artificial Neural Networks to ECG Holter Data), Prof. Z. Pawłowski (tutor), (4)
- [MSc31] Wiesław Oszańca: "*Mikroprocesorowy analizator widma do laboratorium studenckiego*" (Microprocessor Laboratory Spectrum Analyser), Assist. Prof. K. Radecki (tutor), (5)
- [MSc32] Rafał Pałdyna: "*Konstrukcja odbiornika optycznego z analogową demodulacją szerokopasmową do systemów telewizji kablowej*" (Construction of an Optical Receiver with Bandwidth Analogue Demodulation for Cable Television Systems), Prof. J. Modelski (tutor), (5)
- [MSc33] Jurand Piotrowski: "*Zastosowanie szkieletyzacji opartej na morfologii matematycznej do kompresji obrazów*" (Application of Morphological Skeletonization in Image Compression), Prof. J. Modelski / Assist. A. Buchowicz (tutors), (5)
- [MSc34] Marcin Prusaczyk: "*Komputerowa analiza radioizotopowych badań dynamicznych wątroby*" (Computer Analysis of Scintigraphic Liver Studies), Assist. Prof. P. Brzeski (tutor), (4)
- [MSc35] Paweł Prystawko: "*Aparat EKG do bramkowania badania dynamicznego serca*" (Simple Electrocardiograph for Gate Synchronized Acquisition in Nuclear Medicine), Assist. Prof. J. Marzec (tutor), (5)
- [MSc36] Adam Sołtysiak: "*Iteracyjne algorytmy rekonstrukcji obrazów w tomografii SPECT*" (Iterative Reconstruction Algorithms in SPECT Tomography), Assist. Prof. M. Karolczak (tutor), (5)

[MSc37]	Jarosław Szumski: "Problematyka bezpieczeństwa w systemie operacyjnym Windows NT 3.51" (Problems of Window NT3.51 Operating System Security), Assist. Prof. A. Więckowski (tutor), (4)	Device for Sound Recognition for the Deaf), Assist. Prof. K. Radecki (tutor), (5)
[MSc38]	Dariusz Włoskowicz: "Mikroprocesorowy system rozpoznawania wybranych dźwięków dla potrzeb osób niesłyszących" (Microprocessor	[MSc39] Krzysztof Wójcik: "Systemy ekspertowe wykorzystujące graf konwersacyjny" (Expert Systems with Conversation Graph), Assist. Prof. J. Chudziak (tutor), (5)

6. PUBLICATIONS

6.1. Scientific and technical books

- [Pub1] S. Hahn: "Hilbert Transforms", Chapter 7 in "The Transforms and Applications Handbook" (edited by Alexander Poularikas), CRC Press, Inc., Boca Raton, Florida, and IEEE Press, 1996, 160 pages
- [Pub2] S. Hahn: "Hilbert Transforms in Signal Processing", Artech House, Boston-London, 1996, 442 pages
- [Pub3] J. Woźnicki - ed., (co-authors: R. Z. Morawski, Z. Pawłowski): „Elastyczny system studiów dwustopniowych” (Flexible Two-Stage System of Studies), Wydawnictwo Naukowe PWN, Warsaw 1996, 255 pages

6.2. Scientific and technical papers in journals

- [Pub4] A. Avramenko, J. Mirkowski, Z. Pawłowski, A. Piątkowski: „Pion Production in Nuclear Charge Exchange Reactions A(t,3He)”, in: *Nuclear Physics A596*, 1996, pp. 355-366
- [Pub5] W. Barwicz, J. Mosakowski, A. Podgórski: „Podręczny analizator dźwięku i drgań SVAN 912” (Handheld Sound and Vibration Analyser SVAN 912), *Elektronizacja* No.2, 1996, pp.2-4.
- [Pub6] M. Celuch-Marcysiak: "Time-domain Approach to Microwave Circuit Modelling: a View of General Relations between Expanded Node TLM and FDTD", invited paper, *Int. Journal of Microwave and Millimeter-Wave Computer-Aided Engineering*, Vol.6, No.1, 1996, pp.36-46.
- [Pub7] K. Czerwiński, K. Thun-Szretter, H. Markiewicz, D. Leitner: „Systemy cyfrowego obrazowania rentgenowskiego w radiologii stomatologicznej - alternatywa konwencjonalnych zdjęć wewnątrzustnych zębowych” (Digital X-ray Imaging Systems in Dental Radiology - an Alternative to Intraoral Dental Radiographs), *Czasopismo Stomatologiczne*, No.8, 1996, pp.579-585
- [Pub8] K. Derzakowski, A. Abramowicz: "Dielectric resonator figure of merit", *Bulletin of the Polish Academy of Sciences*, Vol.44, No.2, 1996, pp.129-139,
- [Pub9] W. K. Gwarek, M. Celuch-Marcysiak: "A Differential Method of Reflection Coefficient Extraction from FDTD Simulations", *IEEE Microwave and Guided Wave Letters*, Vol.6, No.5, May 1996, pp.215-217
- [Pub10] S. Hahn: „Stochastic Analytic Signals and the Relation between Instantaneous Frequency, Spectral moments and the Wiegner-Ville Distribution”, *Bull. Acad. Polonais Sci.*, No. 4, 1995, pp.525-535
- [Pub11] S. Hahn, K. Snopek: „Problems in the Computation of 2-D Discrete Hilbert Transform”, *Kleinheubacher Berichte*, Band 38, 1995, pp. 63-69
- [Pub12] S. Hahn: „Generation of Random Signals Using Interpolation Functions of the Sampling Theory”, *Kleinheubacher Berichte*, Band 39, 1996, pp. 561-568
- [Pub13] S. Hahn: „The Hilbert Transform of the Product $a(t)\cos(\omega t+\varphi)$ ”, *Bull. Acad. Polonais Sci.*, Nr 1, 1996, *IEEE Transactions on Communications*, Vol. 44, no.7, pp.57-62
- [Pub14] S. Hahn: A comment to the paper: "A Tabulation of Hilbert Transforms for Electrical Engineering", *IEEE Transactions on Communications*, Vol.44, no.7, July 1996, p.768
- [Pub15] S. Hahn: „The N-Dimensional Complex Delta Distribution”, *IEEE Transactions on Signal Processing*, Vol.44, no.7, July 1996, pp.1833-1837
- [Pub16] Shi Huang, R. Z. Morawski, A. Barwicz: „Static Calibration of Transducers Using Gauss-Function-Based Approximation”, *IEEE Transactions on Instrumentation & Measurement*, Vol.45, No.3, June 1996, pp.389-393.
- [Pub17] W. A. Kielek: „Calculation of Time Resolution of Scintillation Counters with Constant Fraction Discriminators”, *Nuclear Instruments & Methods in Physics Research*, Section A 368, 1996, pp.392-402
- [Pub18] E. Kotarbińska, G. Makarewicz, R. Ogłaza, J. Paluchowski, P. Rogowski: „The Stand for the Investigation of Auditory Danger Signals Perception - Preliminary Investigation”, *Archives of Acoustics*, 21, 3, 1996, pp.51-62.
- [Pub19] E. H. Lo, J. Rogowska, P. Bogorodzki, M. Trocha, K. Matsumoto, B. Saffran, G. L. Wolf: „Temporal Correlation Analysis of Penumbral Dynamics in Focal Cerebral

- Ischemia", *Journal of Cerebral Blood Flow and Metabolism*, 1996, 16, pp.60-68
- [Pub20] R. Z. Morawski, L. Szczeciński, A. Barwicz: „Deconvolution Algorithms for Instrumental Applications: A Comparative Study”, *Journal of Chemometrics*, Vol.9, 1995, pp. 3-20.
- [Pub21] R. Z. Morawski, A. Miękina, A. Barwicz: „Combined Use of Tikhonov Deconvolution and Curve Fitting for Spectrogram Interpretation”, *Instrumentation Science & Technology*, 24(3), USA, August 1996, pp. 155-167.
- [Pub22] R. Z. Morawski: „Modelowanie matematyczne a pomiar” (Mathematical Modelling Versus Measurement), *Metrologia i systemy pomiarowe*, Vol.II, book 1 (zeszyt 1), 1995, pp. 25-35.
- [Pub23] G. Opolski, T. Kraska, E. Piątkowska-Janko, K. Słomka, A. Górecki, J. Stanisławska, P. Ścisło, A. Piątkowski, M. Cieciora: „Technika uśredniania załamka P ekg - nowa metoda wyodrębniania chorych z napadowym migotaniem przedsionków” (P-wave Averaging Technique: A New Method of Identifying Patients with Paroxysmal Atrial Fibrillation), *Polski Tygodnik Lekarski*, 1995, T.L., No.40-44, pp.35-41
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7. REPORTS

7.1. Research reports

- [Rep1] K. Adamowicz, P. Sokołowski, R. Leoniak, W. Winięcki: "Automatyzacja systemu odbiorczego Gigatune-18 PAR" (Automation of Broadcasting Signal Acquisition System Gigatune-18 PAR). Technical Documentation (version LabWindows/CVI), Institute of Radioelectronics, WUT, Warsaw, December 1995, 147 pp.
- [Rep2] K. Adamowicz, P. Sokołowski, R. Leoniak, W. Winięcki: "Automatyzacja systemu odbiorczego Gigatune-18 PAR" (Automation of Broadcasting Signal Acquisition System Gigatune-18 PAR). Technical Documentation (version LabWindows/CVI). Test Results. Institute of Radioelectronics, WUT, Warsaw, December 1995, 120 pp.
- [Rep3] K. Adamowicz, P. Sokołowski, R. Leoniak, W. Winięcki: "Automatyzacja systemu odbiorczego Gigatune-18 PAR" (Automation of Broadcasting Signal Acquisition System Gigatune-18 PAR), Manual, Institute of Radioelectronics, WUT, Warsaw, June 1996, 106 pp.
- [Rep4] K. Derzakowski: "Opracowanie metody i programu komputerowego analizy wielowarstwowego stratnego rezonatora dielektryczno-ferrytowego dla wszystkich rodzajów drgań", (The Elaboration of a Method and Computer Program for the Analysis of the Lossy Multilayered Dielectric-ferrite Resonator for all Modes), Institute of Radioelectronics, WUT, Warsaw 1996, 24 pp.
- [Rep5] J. Ebert, M. Mikołajewski, J. Modzelewski, A. Owczarek: „Wysokosprawne układy zasilające do sprzętu elektronicznego” (High-efficiency Supply Circuits for Electronics Equipment), Institute of Radioelectronics, WUT, Warsaw 1996, 19 pp.
- [Rep6] J. Ebert, M. Mikołajewski, J. Modzelewski, A. Owczarek, K. Puczko: „Nowe rozwiązania rezonansowych przetwornic napięcia stałego z prostownikami synchronicznymi” (Novel Circuits of DC/DC Resonant Converters with Synchronous Rectifiers), Institute of Radioelectronics, WUT, Warsaw 1996, 68 pp.
- [Rep7] J. Ebert, M. Mikołajewski, A. Owczarek: „Modulacja amplitudy w tranzystorowych nadajnikach z sumowaniem mocy z wielu modułów” (Amplitude Modulation in Transistor Transmitters with Power Combining), Institute of Radioelectronics, WUT, Warsaw 1996, 28 pp.
- [Rep8] A. Leszczyński, M. Tajchert, J. Paluchowski, A. Aronowski: „System rejestracji i przetwarzania dźwięku” (A System for Sound Recording and Processing), Institute of Radioelectronics, WUT, Warsaw 1996, 16 pp.
- [Rep9] A. Miękina, R. Z. Morawski, A. Podgórski: „Zastosowanie procesorów sygnałowych nowej generacji w aparaturze do pomiaru i analizy dźwięku” (Application of New-Generation Signal Processors in Instrumentation for Sound Measurement and Analysis), Research Report on the Project granted by the Dean, Institute of Radioelectronics, WUT, Warsaw 1996, 19 pp.
- [Rep10] A. Miękina, R. Z. Morawski, A. Podgórski: „Realizacja i badanie wybranych algorytmów wzorcowania torów pomiarowych oraz algorytmów odtwarzania mezurandów” (Implementation and Investigation of Selected Algorithms for Calibration of Measurement Channels and Measurand Reconstruction), Research Report on the Project No 503/034/031/1/RZM granted by the Rector, Institute of Radioelectronics, WUT, Warsaw 1995, 5 pp.
- [Rep11] A. Miękina, R. Z. Morawski, A. Podgórski: „System wspomaganie projektowania algorytmów przetwarzania sygnałów pomiarowych SCR - wersja 2/PC” (A system for Computer-Aided Development of Algorithms for Measurement-Signal Processing), Research Report on Project No 8 S507 003 05 granted by the State Committee for Scientific Research, Institute of Radioelectronics, WUT, Warsaw 1996, 55 pp.
- [Rep12] M. Mikołajewski: „Metody optymalizacji dwupółprzewodnikowych prostowników synchronicznych w.cz.” (Optimalisation Methods of Full-wave High Frequency Synchronous Rectifiers), Institute of Radioelectronics, WUT, Warsaw 1996, 25 pp.
- [Rep13] J. Modelski, A. Buchowicz, T. Krzymień: "Adaptacyjna filtracja obrazów kolorowych" (Adaptive Filtration of Color Images), Institute of Radioelectronics, WUT, Warsaw 1995, 7 pp.
- [Rep14] T. Morawski, W. Gwarek, M. Celuch-Marcysiak, J. Zborowska, W. Wojtasiak, K. Kowalski, W. Kazubski: „Nowoczesne metody analizy i projektowania układów mikrofalowych” (Modern Methods of Analysis of Electromagnetic Fields and Microwave Circuit Design), Institute of Radioelectronics, WUT, Warsaw 1996, 35 pp.
- [Rep15] T. Morawski, W. Wojtasiak, D. Gryglewski: „Metody projektowania podukładów modułu nadawczo-odbiorczego” (Methods of Design of Transmission/Reception Module Subcircuits), Institute of Radioelectronics, WUT, Warsaw 1995, 11 pp.
- [Rep16] T. Morawski, W. Wojtasiak, D. Gryglewski: „Projekt modułu nadawczo-odbiorczego na pasmo L. Opis modelu eksperymentalnego” (Design of Transmission/Reception Module for L-band. Description of Experimental Model), Institute of Radioelectronics, WUT, Warsaw 1995, 41 pp.
- [Rep17] T. Morawski, W. Wojtasiak, D. Gryglewski: „Badanie modelu użytkowego modułu nadawczo-odbiorczego” (Investigations of Trans-

- mit/Receive Module), Institute of Radioelectronics, WUT, Warsaw 1996, 62 pp.
- [Rep18] T. Morawski, J. Zborowska, W. Wojtasiak: „*Analiza i projektowanie mikrofalowych przesuwników fazy z tranzystorami FET oraz diodami PIN i waraktorami*” (Analysis and Design of Microwave Phase Shifters with FET Transistors, PIN diodes and Varactors), Institute of Radioelectronics, WUT, Warsaw 1996, 45 pp.
- [Rep19] T. Morawski, J. Zborowska, W. Wojtasiak, M. Sypniewski, D. Gryglewski: „*Projektowanie mikrofalowych układów aktywnych przełączonych*” (Design of Active and Switchable Microwave Circuits), Institute of Radioelectronics, WUT, Warsaw 1996, 25 pp.
- [Rep20] Z. Pawłowski: „*Detector Setup for a Coder Storage Ring with Internal Target*”, Int. raport of Uppsala Univ., TSL/ISV - 95-0117, Uppsala 1996
- [Rep21] Z. Pawłowski, B. Konarzewski, J. Marzec, K. Zaremba: „*Metodyka i aparatura do badań biokinetyki związków ołowiu w mózgu i tkankach mózgowych*” (Methodology and Equipment for Lead Biokinetics in the Brain), Priority Program "Bioengineering", Warsaw, WUT, 1996, 18 pp.
- [Rep22] A. Piątkowski, P. Bogorodzki, E. Piątkowska-Janko: „*Opracowanie metody synchronizacji tomografu rezonansu magnetycznego sygnałami z układu oddechowego i krążeniowego*” (Triggering Technique of MR Tomography With ECG and Respiratory Signals), Research Report on the Project no 8S50602307 granted by the State Committee for Scientific Research, Warsaw 1996, 70 pp.
- [Rep23] A. Piątkowski, P. Bogorodzki, E. Piątkowska-Janko: „*Filtry cyfrowe do analizy EKG wysokiej rozdzielczości*” (Digital filtering for High-resolution ECG), Research Report on the Project No 8S50601206 granted by the State Committee for Scientific Research, Warsaw 1996, 60 pp.
- [Rep24] W. Winiecki, R. Leoniak: „*Metodyka uruchamiania systemów pomiarowych z interfejsem IEC-625*” (Methodology for IEC-625 Measuring Systems Debugging and Testing), Institute of Radioelectronics, WUT, Warsaw 1996, 33 pp.
- [Rep25] K. Zaremba et al.: „*Halo Measurements at 190 GeV in SMC*”, CERN/SMC Internal Report, Geneva 1996, 12 pp.
- [Rep26] K. Zaremba et al.: „*Halo Measurements at 100 GeV in SMC*”, CERN/SMC Internal Report, Geneva 1996, 9 pp.

8. HOME PATENTS

- [Pat1] Z. Łapiński, K. Kowalski, et al.: „*Ways of Testing the Dynamic Properties Antiaircraft Missile Control Systems and Monitoring Equipment for Testing These Systems*”, Patent RP, No. 0621, January 22, 1996
- [Pat2] J. Modzelewski: „*Układ do pomiaru charakterystyk statycznych lamp mocy*” (A System for Measurement of Electron Power Tube Characteristics), Patent RP, No. 169862, 30.09.96
- [Pat3] M. Mikołajewski, J. Modzelewski: „*Sposób regulacji mocy wielkiej częstotliwości i układ regulacji mocy wielkiej częstotliwości*” (A Method of High Frequency Power Regulation and a System for High Frequency Power Regulation), Patent application No. P. 314 410, 24.05.96

9. CONFERENCES, SEMINARS AND MEETINGS

9.1. International conferences

- [Con1] *URSI Conference "Kleinheubacher Tagung"* (Kleinheubach, Germany, October 1-8, 1995), S. Hahn (participant), J. Jarkowski (participant)
- [Con2] *International Conference on Image Processing* (Washington, USA, October 22-25, 1995), A. Buchowicz (speaker).
- [Con3] *International Symposium on Signals, Systems and Electronics* (San Francisco, USA, October 25-27, 1995), A. Buchowicz (speaker).
- [Con4] *6th International Conference Industrial Metrology CIMI'95* (Zaragoza, October 25-27, 1995), R. Z. Morawski (speaker).
- [Con5] *5th IMEKO TC-14 Symposium on Dimensional Metrology in Production and Quality Control ISMQC'95* (Zaragoza, October 25-27, 1995), R. Z. Morawski (participant).
- [Con6] *5th International Conference on Non-Invasive Cardiology* (Izrael, 17-21.12.1995), A. Piątkowski, E. Piątkowska-Janko, P. Bogorodzki (speakers).
- [Con7] *3rd European Conference on Optical Chemical Sensors and Biosensors* (Zurich, Switzerland, March 31 - April 3, 1996), P. Kluk (speaker).
- [Con8] *3rd IEE International Conference „Computation in Electromagnetics”* (Bath, UK, April 1996), M. Celuch-Marcysiak (speaker).
- [Con9] *11th International Microwave Conference MIKON-96* (Warsaw, Poland, May 1996),

- J. Modelski (chairman of TPC), T. Morawski (speaker, member of the Program Committee), W. Gwarek (invited speaker, member of TPC), M. Celuch-Marcysiak (speaker), K. Derzakowski (speaker), D. Gryglewski (speaker), J. Jarkowski (speaker), P. Miazga (speaker), W. Wojtasiak (speaker).
- [Con10] *IEEE MTT Symposium (San Francisco, USA, June 1996)*, W. Gwarek (speaker)
- [Con11] *IEEE Instrumentation and Measurement Technology Conference - IMTC'96 (Brussels, Belgium, June 4-6, 1996)*, A. Miękina (speaker), R. Z. Morawski (speaker, session chairman).
- [Con12] *IEEE International Symposium on Industrial Electronics, ISIE'96 (Warsaw, June 17-20, 1996)*, M. Mikolajewski (speaker).
- [Con13] *The 1st International Conference on Bioelectromagnetism (Tampere, Finland, June 9-13, 1996)*, E. Piątkowska-Janko (speaker).
- [Con14] *The 10th Nordic-Baltic Conference on Biomedical Engineering (Tampere, Finland, June 9-13, 1996)*, P. Bogorodzki, A. Przelaskowski (speakers).
- [Con15] *CAR'96 (Paris, June 1996)*, P. Bogorodzki (speaker), W. Frey (participant).
- [Con16] *Thirteenth International Wrocław Symposium and Exhibition on Electromagnetic Compatibility (Wrocław, Poland, June 25-28, 1996)*, J. Cichocki (participant), J. Kolakowski (participant), S. Żmudzin (participant).
- [Con17] *International Congress on Sound & Vibration (St. Petersburg, Russia, June 22-28, 1996)*, E. Kotarbińska (speaker).
- [Con18] *ASEE Annual Conference (Washington, USA, July 23-26 1996)*, R. Z. Morawski (speaker)
- [Con19] *IEEE Symposium on Antennae and Propagation (Baltimore, USA, July 21-25, 1996)*, M. Celuch-Marcysiak (speaker).
- [Con20] *URSI National Radio Science Meeting (Baltimore, USA, July 21-25, 1996)*, M. Celuch-Marcysiak (speaker).
- [Con21] *XVIIIth Congress of European Society of Cardiology (Birmingham, GB, August 25-29, 1996)*, A. Piątkowski (participant), E. Piątkowska-Janko (speaker)
- [Con22] *XXVth General Assembly of URSI (Lille, Francja, August 28-September 5, 1996)*, K. Derzakowski (speaker), A. Buchowicz (speaker).
- [Con23] *European Microwave Conference (Prague, Czech Rep., Sept. 1996)*, J. Modelski (member of TPC).
- [Con24] *8th TC-4 IMEKO International Symposium On New Measurement and Calibration Methods for Electrical Quantities in Instruments (Budapest, Sept. 16-17, 1996)* - A. Podgórski (speaker), W. Winiecki (speaker).
- [Con25] *Conference of URSI National Committee "Kleinheubacher Tagung" (Kleinheubach, Germany, Sept. 28-October 6, 1996)*, S. Hahn, J. Jarkowski.
- [Con26] *9th Piezoelectric Conference (Waplewo, 2-4 October 1996)*, J. Cichocki (participant), S. Żmudzin (participant).
- [Con27] *(KAS Symposium on Higher Education Renewal in Middle and East Europe) Konrad-Adenauer Stiftung Symposium über Hochschulerneuerung in Mittel- und Osteuropa (Bonn, Germany, December 9-10, 1996)* - R. Z. Morawski (speaker).

9.2. Local conferences

- [Con28] *VIII Krajowa Konferencja Metrologii (VIII National Measurement Conference) (Warszawa-Zegrze, October 18-20, 1995)*, A. Fiok (member of the Scientific Committee, session chairman, speaker), J. Cichocki (speaker), R. Leoniak (speaker), W. Winiecki (speaker)
- [Con29] *Konferencja Naukowo - Techniczna "Europejskie projekty naukowo-badawcze na rzecz osób niewidomych i niepełnosprawnych - TIDE" (European Research Projects for the Blind and the Handicapped), Ośrodek Informacji i Promocji Postępu Naukowo-Technicznego Polskiego Związku Niewidomych (Warsaw, October 19, 1995)*, T. Buczkowski (speaker), T. Kosito (speaker), K. Radecki (speaker)
- [Con30] *Symposium "Telekomunikacja bez granic" (Telecommunication without Frontiers), TP S.A. (Warsaw, November 14, 1995)*, T. Buczkowski (participant), T. Kosito (participant), K. Radecki (participant)
- [Con31] *Krajowa konferencja „Człowiek a komputer. Medycyna” (Man and Computer. Medicine), (Warsaw, November 1995)*, A. Przelaskowski (speaker)
- [Con32] *VIII Krajowe Sympozjum Nauk Radiowych URSI '96 (VIIIth National Radio Science Symposium), (Wrocław, February 15-16 1996)*, PAN, Komitet Narodowy Międzynarodowej Naukowej Unii Radiowej, International Union of Radio Science, Politechnika Wrocławska; S. Hahn (chairman of the Program Committee, speaker), J. Jarkowski (participant), T. Kosito (participant), K. Radecki (member of the Program Committee, session chairman, speaker), J. Modzelewski (speaker)
- [Con33] *Krajowa Konferencja Radiokomunikacji Ruchomej KKRR '96 (National Mobile Radiocommunication Conference), (Poznań, June 3-5, 1996)*, J. Cichocki (participant), J. Kolakowski (participant)
- [Con34] *Krajowe Sympozjum Telekomunikacji (National Telecommunication Symposium), (Bydgoszcz, September 11-13, 1996)*, J. Cichocki (participant)
- [Con35] *I Krajowa Konferencja "Zastosowania satelitarnego systemu lokalizacyjnego GPS"*

- (Application of Satellite Geographical Position System GPS), (Poznań, 7 listopada 1996), S. Żmudzin (participant)
- [Con36] *IV Konferencja Naukowa „Czujniki Optoelektroniczne i Elektroniczne COE '96” (Optoelectronic and Electronic Sensors), (Szczyrk, 13-16 maja 1996), K. Radecki (speaker)*
- [Con37] *National Symposium of Radio Science (Wrocław 1996), T. Morawski (speaker), J. Zborowska (speaker)*
- [Con38] *XVIII-th National Conference on Circuit Theory and Electronic Circuits (Polana Zgorzelisko, October 25-28, 1995), T. Morawski (member of the Program Committee), K. Derzakowski (speaker)*
- [Con39] *II Konferencja Sieci Neuronowych i Ich Zastosowań (IIth Conference on Neural Networks and Their Applications), (Szczyrk, 30.04-04.05.1996), A. Kozak (speaker)*
- [Con40] *Krajowa Konferencja „Algorytmy Ewolucyjne” (National Conference on Evolution Algorithms), (Murzasichle, 12-15 czerwca 1996), P. Miazga (speaker)*
- [Con41] *IV Kraj. Symposium Pomiarów Magnetycznych (4th Polish Symposium on Magnetic Measurements), (Kielce - Borków, October 12-14, 1995), A. Miękina (speaker).*
- [Con42] *XXVIII Międzyuczelniana Konferencja Metrologów MKM'96 (XXVIIIth Inter University Metrologists' Conference), (Częstochowa, September 22-25, 1996), W. Winiecki (lecturer), R. Leoniak (speaker), R. Z. Morawski (member of the Scientific committee).*
- [Con43] *XIXth National Conference on Circuit Theory and Electronic Circuits (Kraków-Krynica, 23-26.10.1996), M. Mikołajewski (speaker), J. Modzelewski (speaker)*
- [Con44] *Ogólnopolska konferencja: Szkoły wyższe: problemy minionej i przyszłej kadencji rektorskiej (Polish Conference: Universities - Problems of the Past and Future Rectors' Terms), (Warsaw, October 25-26, 1996), R. Z. Morawski (speaker).*
- [Con45] *V Zjazd Naukowy Towarzystwa Medycyny Nuklearnej (V Symposium of Nuclear Medicine Society), (Gdańsk, May 29-31, 1996), W. Smolik (participant), R. Szabatin (participant), P. Brzeski (speaker)*
- [Con46] *Seminar on FDTD applications to electromagnetic modelling (Chalmers University of Technology, Gothenburg, Sweden, Nov. 1995), M. Celuch-Marcysiak (invited speaker).*
- [Con47] *Seminar and software presentation (University of Kent, Canterbury, UK, Dec.1996),*
- M. Celuch-Marcysiak, A. Kozak (invited speakers).
- [Con48] *Seminar and software presentation at Helsinki University of Technology (Helsinki, Finland, Feb.3-8, 1996), W. Gwarek, M. Sypniewski (invited speakers)*
- [Con49] *Seminarium programu priorytetowego "Bioinżynieria" (WUT Seminar of priority program „Bioengineering”), (WUT, Warsaw, March 1996), Z. Pawłowski, A. Piątkowski, J. Marzec, B. Konarzewski, K. Zaremba, R. Szabatin, P. Brzeski, E. Piątkowska-Janko, P. Bogorodzki (speakers).*
- [Con50] *Motorola Seminar „European Frame Relay” (Warsaw, March 25, 1996), T. Buczkowski, T. Kosito, K. Radecki (participants)*
- [Con51] *Motorola Seminar „Smart - Zone - TETRA” (Warsaw, April 10, 1996), T. Buczkowski, T. Kosito, K. Radecki (participants)*
- [Con52] *Advanced Test Solutions for Aerospace and Defence Seminar (HP Polska, Warsaw April 3, 1996), J. Kołakowski (participant), S. Żmudzin (participant)*
- [Con53] *Seminarium Zakładu Grafiki Komputerowej II PW i Komitetu Informatyki PAN „Grafika komputerowa, przetwarzanie i rozpoznawanie obrazów” (Computer Graphics Image Processing and Recognition), (WUT, Warsaw, May 1996), A. Przelaskowski (speaker)*
- [Con54] *IEEE MTT/AP/AES seminar (Warsaw, May 1996), M. Celuch-Marcysiak, A. Kozak, (speakers).*
- [Con55] *Seminarium programu priorytetowego "PATIA" (WUT Seminar of priority program „PATIA”), (WUT, Warsaw, 21.06.1996), J. Narkiewicz-Jodko (speaker)*
- [Con56] *Seminarium „50-cio lecie Inżynierii Biomedycznej w Politechnice Warszawskiej” (50th Anniversary of Biomedical Engineering in WUT), (WUT, Warsaw, June 1996), Z. Pawłowski (speaker)*
- [Con57] *Seminarium "Techniki dostępu radiowego" (Seminar „Radio Access Techniques”), (Ericsson Polska, Warsaw June 21, 1996), J. Cichocki (participant), J. Kołakowski (participant), S. Żmudzin (participant)*
- [Con58] *2nd IEEE-EMBS International Summer School on Biomedical Imaging (Brittany, France, June 22 - July 1, 1996), A. Przelaskowski (participant), W. Smolik (participant)*
- [Con59] *Sixth International Summer School "Microwave and Lightwave Electronics" (WUT, Warsaw, 14-17 July 1996), J. Modelski J.(speaker), T. Kosito (speaker), W. Gwarek (speaker)*
- [Con60] *Workshop on Soft and Hard Surfaces (Baltimore, USA, July 26, 1996), M. Celuch-Marcysiak (speaker).*
- [Con61] *Der Tagung des URSI - Landesausschusses in der Bundesrepublik Deutschland (Deutsche*

Bundespost Telekom, Kleinheubach, 1996), S. Hahn (speaker), J. Jarkowski (participant)

[Con62] *IEEE Seminar (Chalmers, Nov.1996)*, W. Gwarek (participant)

[Con63] *Seminarium polsko-japońskie "Contribution of Electrical and Electronics Engineering to Biology and Medicine" (Warsaw, IBIB PAN, No-*

vember 5-8, 1996), A. Piątkowski, E. Piątkowska-Janko (speakers)

[Con64] *Zebranie naukowe Komisji Teorii Pomiaru i Komisji Kształcenia Komitetu Metrologii i Aparatury Naukowej PAN (Scientific Meeting of the Measurement Theory Section and the Education Section of the Metrology and Instrumentation Committee, Polish Academy of Sciences), (DPT "Ustronie", Jan. 3-5, 1996)*, P. Kluk (speaker), W. Winiecki (speaker).

10. STATISTICAL DATA

SPECIFICATION	1996
academic staff total	77,5
full professors	4
professors	5
associate professors	0
assistant professors	31,5
senior lecturers	2
lecturers	2,5
assistants	10,5
Ph.D. students	22
technical staff	20,5
administrative staff	7
other staff	2
space total	2415,1
laboratories	1038,3
library	71,2
offices of academic staff	1305,6
computers total	125
workstations	4
personal computers (PC 486 and better)	121
library resources	
books (number of volumes)	12 239
books (number of titles)	7 071
journals (number of titles subscribed to)	256
teaching activities	
basic courses	39
advanced courses	44
other courses	24
international projects	2
research projects total	54
granted by the University	26
granted by the State institutions	12
other projects	16
degrees awarded	
Ph.D. degrees	2
M.Sc. degrees	40
publications total	84
sci.-tech. Books	3
sci.-tech. papers in journals	23
sci.-tech. papers in conference proceedings	55
teaching aids	2
other publications	1
research reports	20
patents	
patents granted	2
patent application	1
conferences	
number of conferences attended by the staff	32
number of participants from the Institute	76