INSTITUTE OF RADIOELECTRONICS AND MULTIMEDIA TECHNOLOGY

WARSAW UNIVERSITY OF TECHNOLOGY

FACULTY OF ELECTRONICS AND INFORMATION TECHNOLOGY

ANNUAL REPORT

2016

Warsaw, February 2017

Institute of Radioelectronics and Multimedia Technology
Warsaw University of Technology
Nowowiejska 15/19
00-665 Warsaw
Poland

Head Office
room: 422
phone: +48 22 234 7233, +48 22 825 3929
fax: +48 22 825 3769

Internet information
http://www.ire.pw.edu.pl

Edited by:
Y. Yashchyshyn
A. Noińska
J. Marzec

 Printed in Oficyna Wydawnicza Politechniki Warszawskiej

From the Outgoing Director

I have a great pleasure and honour to welcome you for the 21st time to the edition of our Annual Report. The last two decades posed great challenges for the Institute. That was in the combined perspective of global digital and technological revolution on the one hand, while crucial political, economical, and educational changes in our country - on the other.

In 1970s the Institute developed wide spread collaboration with industry. In particular, it could be proud of its contribution to development of new electronic products. However, the decade ended with deep economic crisis followed by the years of the martial law and economic stagnation. The transformation of the political and economic system started in 1989 and were of historical dimension for the freedom and development of our country. However, initially they did not make our life easier. Numerous companies who traditionally were our partners either vanished or have fallen into financial trouble. The Institute had to look for completely new sources of funding. State budgetary sources oriented towards didactic and statutory activities proved too scarce to maintain the number and quality of our staff.

One may conclude that 20 years ago the future of our Institute was quite uncertain- both due to an overall financial deficit and to the staff issue. In the team of 56 researchers-teachers, only 9 persons were tenured or associated professors. Four of them were facing severe health problems and taking long-term leaves. Two divisions had no any professor at all. Moreover the prospects seemed quite bleak since too few habilitation theses were under way.

Year 1996 brought important decisions were taken with respect to the scope of teaching and research as well as in the policy of human resources. Three main areas of activities were identified. They were: radiocommunication, multimedia technologies and medical electronics. The reform of the Institute was aimed at gaining recognised positions in those areas. Their choice was motivated by our predictions of trends in the technology development as well as in the commercial needs arising from the economic changes in our country.

The following milestones may be distinguished in our quest towards the new goals:

- 14 habilitation and 99 Ph.D. theses,
- 33 international projects, 99 national projects, and 170 contracts,
- two new specialisations of teaching: *Radiocommunication and Multimedia Technologies, Biomedical Engineering,*
- various forms of continuous education (evening studies, specialists courses RADEM, post-diploma studies),
- creating new laboratories *(e.g. Antenna Techniques, Mobile Digital Systems, Radiocommunication Measurements, Multimedia Technologies)*.

Under the Institute's supervision, nearly 3000 B.Sc. and M.Sc. theses were implemented and over 3600 publications completed. A substantial part thereof focused on multimedia technologies. To better reflect its current activities, in 2015 the Institute was renamed as the Institute of Radioelectronics and Multimedia Technologies.

I shall conclude that over the last 20 years, the Institute has come a long way from an equipment - apparatus unit (working mainly in the field of electronics) to a truly interdisciplinary one (in telecommunications - electronics - informatics). It combines two balanced systematic parts of equipment and informatics. Compared to mid-1990s, our financial position has greatly improved. Moreover, the number of professors doubled, while the number of doctoral students tripled. The processes of habilitation and doctorisation appear stable. Our laboratory basis has been enlarged and refurbished. We have intensified our vital activity in publications as well as in R&D on the international arena.

The Institute has excellently passed its hard times exam and resolved most of the problems. The key weapons have been the dedication and entrepreneurship of our staff combined with the consistent vision for development. Nowadays, the Institute of Radioelectronics and Multimedia Technologies enjoys a high reputation within as well as outside of the University. Looking backward, we feel we may congratulate ourselves on wellaimed choices of strategic directions for development. Looking forward, I feel certain that our successors are well prepared for facing further interdisciplinary challenges.

When closing my 20-year-long adventure of heading the Institute, I wish to thank all the colleagues working at the Institute for their deep involvement, hard work and dedicate service. I am deeply grateful to all of those who identified with our goals, and who supported and sponsored our activities

I would like to warmly wish the new Director a lot of success in further development of the Institute, as well as much personal satisfaction of that well done job.

Warsaw, February 2017

Professor Józef Modelski

Classification of publications presented in this Report
is in accordance with the rules in force in 2016

Contents

1. GENERAL INFORMATION

1.1. Mission of the Institute

In defining its mission, the Institute of Radioelectronics and Multimedia Technology is amenable to contemporary needs of academia, industry, and society. Therefore, it aims at the three measurable objectives: to provide teaching of societal relevance; to seek excellence in scientific research; and to run projects meeting the international standards. Technically, we focus on the well-defined specializations: radioelectronics, multimedia, nuclear and medical electronics. These are very well perceived by our students and partners in national and international activities.
As educators, our staff performs sterling work and exhibit immense stamina. The effects are directly measurable in terms of quality and numbers of supervised diplomas. Our graduates prove competitive on the demanding job market in Poland and abroad. They find employment in telecommunication services, mobile communications, information technology, television, and also in public services. We reach further into these sectors through the successful scheme of continuing education. The offer of courses including Radioelectronics and Multimedia Technology attracts an increasing number of participants.

As researchers, we are faithful to the highest standards of the Faculty and the University. We also feel quite unique due to an extremely broad spectrum of addressed subjects, which comprise:

- In Radioelectronics

We are interested in all theoretical and practical aspects concerning transmitting and receiving parts of radio systems. As radio systems we understand radio broadcasting systems, telecommunication systems including various configurations from point-to-point to multiple input-multiple output systems as well as the radio-location and radio-navigation systems. These systems can operate in narrow band, wide band or ultra-wide band. Special attention has been recently put on reconfigurable and software-defined radio systems (incl. smart and reconfigurable antennas).

The frequency range of our interest spans from kHz range (for high efficiency energy conversion) through all ranges used in classical telecommunication up to the terahertz and optical range.

In our applied research we have a vast experience in designing up-to-date, ready to use parts of the radio systems including various types of antennas, power amplifiers, modulators and even entire TR modules for radar systems.

We also specialize in physical aspects of the propagation of electromagnetic and acoustic waves. The waves are interested for us as the means of transmission of the telecommunication information but also as the means of transmitting high power and/or means of investigating the properties of materials (incl. semiconductors, ferroelectrics, graphene, composites etc.).

- In Multimedia

Multimedia at our Institute assembles various lines of research in visual and audio technology. The Multimedia branch comprises people working in two major research and teaching groups: the Television Division and the Electroacoustics Division. Activities of the Television Division focus on media compression, object recognition in images, and digital processing for measurement signals. Moreover, media security, extracting 3D models from video streams, the augmented reality for TV applications, and novel multimedia applications based on deep, convolution, and recurrent artificial neural networks - extend the traditional area of research and teaching in the Television Division.
The Electroacoustics Division, in its research and teaching, focuses on fundamental and applied issues in acoustics, electroacoustics, design of sound systems, signal processing for audio as well as various aspects of perception of sound including noise control and its effects on people.

- In Nuclear and Medical Electronics

Nuclear and Medical Electronics assemble designing of the detectors and front-end electronics for high energy physics and neutrino experiments (e.g. COMPASS – CERN, T2K – Japan), software and hardware developments in Magnetic Resonance Imaging (MRI), like studies of hyper-polarization (DNP) with RF and processing methods in functional and structural neuroimaging, data analysis in proteomics, software and hardware developments in Electrical Capacitance Tomography and Nonoparticle Magnetic Tomography.

It is also our ambition to implement the new scientific knowledge into a good engineering practice. The Institute covers the full process of technological development, from innovative ideas up to the construction of prototypes.

The Foundation for Development of Radiocommunications and Multimedia Technology plays a special role in perpetuating scientific research within our Institute and the whole Faculty. The Foundation subsidizes undergraduate and graduate scholarships. It monitors and awards the progress of young Polish researchers. Its generous support helps us face the socio-economical obstacles, and compete with commercial opportunities awaiting the young people on the open market.

1 .2. Board of Directors

Director of the Institute

Józef Modelski, Prof. D.Sc., Director till Aug. 2016
Wiesław Winiecki, Prof. D.Sc., Director from Sept. 2016
room: 422, phone: +48 22 2347233,+48 22 8253929
e-mail: W.Winiecki@ire.pw.edu.pl

Secretariat

Anna Tratkiewicz
room: 422, phone: +48 22 2347233,+48 22 8253929
fax: +48 22 8253769
e-mail: A.Tratkiewicz@ire.pw.edu.pl

Anna Smenda
room: 422, phone: +48 22 2347742,+48 22 8253929
fax: +48 22 8253769
e-mail: A.Smenda@ire.pw.edu.pl

Deputy Director for Research

Wiesław Winiecki, Prof. D.Sc., Dep. Director for Research till Aug. 2016
Yevhen Yashchyshyn, Prof. D.Sc., Dep. Director for Research from Sept. 2016
room: 426, phone: +48 22 2345367,+48 22 2347727
e-mail: E.Jaszczyszyn@ire.pw.edu.pl

Secretariat

Anna Noińska
room: 426, phone: +48 22 2345367
e-mail: A.Noinska@ire.pw.edu.pl

Deputy Director for Academic Affairs

Jacek Cichocki, Ph.D., Reader
room: 424, phone: +48 22 2347829,+48 22 8255248
e-mail: J.Cichocki@ire.pw.edu.pl

Secretariat

Monika Różycka, M.A.
room: 424, phone: +48 22 2347829, +48 22 8255248
fax: +48 22 8255248
e-mail: M.Rozycka@ire.pw.edu.pl

Director's Representative for Economy & Administration

Piotr Brzeski, Ph.D., Senior Lecturer (0.5)
room: 422, phone: +48 22 2347742, +48 8253929
e-mail: P.Brzeski@ire.pw.edu.pl

1.3. Organisation of the Institute

The Institute of Radioelectronics and Multimedia Technology consists of the following research and teaching divisions:

- Electroacoustics Division;
- Microwave and Radiolocation Engineering Division;
- Nuclear and Medical Electronics Division;
- Radiocommunications Division;
- Television Division.

The structure of the Institute includes Library, Accounting Department, Supply Section.

1.3.1. Electroacoustics Division

Head of Division

Jan Żera, D.Sc., Professor
room: 131, phone: +48 22 2347999
e-mail: J.Zera@ire.pw.edu.pl

Senior academic staff

Zbigniew Kulka, Prof. D.Sc., Professor (0.5 to Sept. 2016)
Wiesław Winiecki, Prof. D.Sc., Professor
Piotr Bilski, D.Sc., Professor
Ewa Kotarbińska, Ph.D., Assistant Professor (0.25)
Marcin Lewandowski, Ph.D., Assistant Professor
Robert Łukaszewski, Ph.D., Assistant Professor
Grzegorz Makarewicz, Ph.D., Assistant Professor (0.5)
Krzysztof Mroczek, Ph.D., Assistant Professor
Piotr Bobiński, Ph.D., Senior Lecturer

Junior academic staff

Agnieszka Pietrzak, M.Sc., Assistant (from Dec. 2016)

Technical staff

Grzegorz Makarewicz, Ph.D., Development Engineer (0.5)

Ph.D. Students

Jakub Pach, M.Sc., from Feb. 2013
Bartosz Połok, M.Sc., from Oct. 2015
Agnieszka Pietrzak, M.Sc., from Feb. 2015
Agata Rogowska, M.Sc., from Oct. 2012
Augustyn Wójcik, M.Sc., from Oct. 2015
Bartosz Żłobiński, M.Sc., from Feb. 2015

Retired

Zbigniew Kulka, Prof. D.Sc., Professor (from Oct. 2016)
Andrzej Leszczyński, Ph.D.,
Maria Tajchert, Ph.D.

The activities of the Division concern electroacoustics and digital audio techniques, including investigations, measurements and applications. They are focused on:

- foundamentals of acoustics;
- electroacoustics;
- psychoacoustics;
- digital audio;
- design and measurements of electroacoustic transducers;
- investigation and modeling of acoustic field distribution;
- noise control and active noise reduction;
- architectural and industrial acoustics;
- sound studio techniques;
- hearing protection.

Current research topics include:

- digital audio signal processing;
- low-level acoustic signals measurements and analysis;
- objective and subjective methods of sound quality evaluation;
- detection of auditory warning signals in the presence of industrial noise;
- elaboration of computation methods for acoustic field radiated in free space by surface acoustic sources and their implementation on a PC.

The other field of interest concerns fundamental and applied research associated with metrology, instrumentation and measuring systems. It is focused on design of automated computer-based measuring systems. Current research topics include:

- modern information technologies, e.g. LabVIEW, Java, XML, and modern communication technologies, e.g. the Internet, GSM, Bluetooth, ZigBee in distributed control and measuring systems;
- virtual instrumentation, plug-in boards for data

acquisition, IEEE-488 equipment;
- artificial intelligence methods in diagnostics of analog systems;
- non-invasive methods for monitoring and analysis of electricity consumpsion in the area of the end users.

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

1.3.2. Microwave and Radiolocation Engineering Division

Head of Division

Wojciech Gwarek, Prof. D.Sc., Tenured Professor
room: 544, phone: +48 22 2347725
e-mail: W.Gwarek@ire.pw.edu.pl

Senior academic staff

Stanisław Rosłoniec, Prof. D.Sc., Tenured Professor (0.5)
Bartłomiej Salski, D.Sc., Associate Professor
Wojciech Wojtasiak, D.Sc., Associate Professor
Małgorzata Celuch, Research Assistant (0.5)
Daniel Gryglewski, Ph.D., Assistant Professor
Paweł Kopyt, Ph.D., Assistant Professor
Przemysław Korpas, Ph.D., Assistant Professor
Przemysław Miazga, Ph.D., Assistant Professor
Dawid Rosołowski, Ph.D., Assistant Professor
Maciej Sypniewski, Ph.D., Assistant Professor

Technical staff

Mirosław Lubiejewski, Foreman

Ph.D. students

Marcin Góralczyk, M.Sc., from Oct. 2014
Tomasz Karpisz, M.Sc., from Feb. 2015
Mateusz Krysicki, M.Sc., from Oct. 2014
Dawid Kuchta, M.Sc., from Oct. 2014
Adam Raniszewski, M.Sc., from Feb. 2015

Temporary Staff

Marcin Piasecki, Ph.D., R&D Engineer (0.5)

Retired

Tadeusz Morawski, Prof. D.Sc.

The Microwave and Radiolocation Engineering Division conducts scientific and applied research in the area of electromagnetic field theory, microwave theory and techniques, and measurement techniques for very high frequency ranges. This includes the subjects of computer-aided design, data acquisition and data processing. Specific research topics in 2016 included: design of high-frequency systems for radiocommunication and radar applications (oscillators, synthesizers, modulators, amplifiers, transmitter/receiver modules); methods of synthesis and computer-aided design of passive and active microwave circuits (couplers, power combiners and dividers, switches, transistor circuits); analysis and design of multi-element planar in-phase radar antenna arrays intended to work at high power level; numerical electromagnetic compatibility analysis; methods for measurements of electric and magnetic properties of materials at microwave frequencies; development of numerical methods and implementation of computer programs for full-wave analysis and design of two- and three-dimensional microwave circuits (filters, periodic guiding structures, matching circuits, structures incorporating dispersive and anisotropic media, antennae); methods of coupled electromagnetic-thermodynamic simulations, design of microwave heating applicators for material science applications; methods of coupled electromagnetic-optical modeling; radio-frequency identification and wireless sensing; development of multithread and distributed programming techniques, non-linear programming, and artificial intelligence methods for application in automated design of microwave circuits.

1.3.3. Nuclear and Medical Electronics Division

Head of Division

Krzysztof Zaremba, Prof. D.Sc., Tenured Professor
room: 72, phone: +48 22 2347955, +48 22 2345780, +48 22 2347497
e-mail: K.Zaremba@ire.pw.edu.pl

Senior academic staff

Marek Krawczyk, Prof. M.D. Ph.D. (0.5, from Nov. 2016)
Janusz Marzec, D.Sc., Professor
Piotr Bogorodzki, D.Sc., Professor
Waldemar Smolik, D.Sc., Associate Professor
Grzegorz Domański, Ph.D., Assistant Professor
Michał Dziewiecki, Ph.D., Assistant Professor
Bogumił Konarzewski, Ph.D., Assistant Professor
Ewa Piątkowska-Janko, Ph.D., Assistant Professor
Piotr Płoński, Ph.D., Assistant Professor (from Nov. 2016)
Dariusz Radomski, Ph.D., Research Assistant Professor
Tymon Rubel, Ph.D., Assistant Professor
Błażej Sawionek, Ph.D., Assistant Professor (0.5)
Roman Szabatin. Ph.D., Assistant Professor (0.5 to Sept. 2016)
Piotr Brzeski, Ph.D., Senior Lecturer (0.5)
Tomasz Jamrógiewicz, M.Sc., Senior Lecturer (0.75 to Sept., 0.5 from Oct. 2016)
Robert Kurjata, Ph.D., Senior Lecturer
Tomasz Olszewski, M.Sc., Senior Lecturer

Junior academic staff

Jacek Kryszyn, M.Sc., Assistant
Jarosław Orzeł, M.Sc., Assistant (0.5)
Wojciech Obrębski, M.Sc., Assistant (0.5)
Andrzej Rychter,Ph.D., Assistant
Marcin Ziembicki, M.Sc., Assistant

Technical staff

Błażej Sawionek, Ph.D., Senior R&D Eng. (0.5 to Aug. 2016)
Andrzej Wasilewski, Worker
Joanna Witkowska, Specialist

Ph.D. students

Monika Drabik, M.Sc. from Oct. 2016
Bartosz Kossowski, M.Sc., from Oct. 2013
Jacek Kryszyn, M.Sc., from Oct. 2012
Jarosław Orzeł, M.Sc., from Oct. 2013
Mateusz Stosio, M.Sc., from Oct. 2015
Damian Wanta, M.Sc., from Oct. 2016
Michał Wieteska, M.Sc., from Feb. 2015
Przemysław Wróblewski, M.Sc., from Oct. 2013

Retired:

Zdzisław Pawłowski, Prof. D.Sc.
Roman Szabatin, Ph.D. (from Oct. 2016)

The research and teaching activities carried out in the Nuclear and Medical Electronics Division are concentrated on two areas: biomedical engineering and nuclear electronics. Research in the interdisciplinary area of biomedical engineering covers a broad range of topics and integrates sophisticated electronics and information technology with elements of medical knowledge. The activity in the area of nuclear engineering is concentrated on the design of electronics systems and data processing software for high energy physics experiments. The Division's research is focused on the following topics:

- nuclear medicine (emission tomography: SPECT, PET);
- magnetic resonance imaging (MRI), functional MRI, advanced applications of MRI;
- optical tomography;
- quantitative computer-aided tomography;
- tomographic dynamic studies;
- process tomography, impedance tomography;
- analogue and digital radiography;
- medical image processing and recognition;
- methods and instrumentation for electrocardiography;
- medical applications of isotope techniques;
- telemedicine;
- design of apparatus and software for high energy physics experiments;
- data analysis in genetics and proteomics;
- mathematical modeling of physiological and disease processes.

Areas of recent studies include:

- advanced applications of MRI and CT imaging systems, covering: dynamic scanning protocols, a new methodology and instrumentation for functional MRI, fMRI image analysis methods;
- a new contrast media for MRI: functional lung imaging with hyper-polarized He3, Xe129;
- multi-modal imaging of topographic, tomographic and functional studies in medicine;
- electrical instability of heart study research, high resolution ECG systems;
- digital structural radiography, modeling of radiographic imaging systems;
- optical tomography applications in medicine;
- algorithms for image reconstruction for electrical and process tomography;
- construction of capacitance tomographs and sensors for medical and industrial applications;
- study of a bioelectrical activity of a pregnant uterus and using EHG for telemetric monitoring of upcoming labor;
- application of nonlinear predictive algorithms to control of insulin dosing in diabetic patients;
- algorithms for the data analysis in genomics and proteomics;
- development of detectors, front-end electronics, and test devices for high energy physics experiments;
- applications of "soft-computing" methods (neural networks, evolutionary algorithms, etc.) for data processing and analysis in high energy physics experiments.

1.3.4 Radiocommunications Division

Head of Division

Yevhen Yashchyshyn, Prof. D.Sc., Head of Division (to Aug. 2016)

room: 33, phone: +48 22 2347727
e-mail: E.Jaszczyszyn@ire.pw.edu.pl

Józef Modelski, Prof. D.Sc., Head of Division (from Sept. 2016)

room: 535, phone: +48 22 2347723
e-mail: J.Modelski@ire.pw.edu.pl

Senior academic staff

Kajetana Snopek, D.Sc., Associate Professor
Jacek Cichocki, Ph.D., Reader
Paweł Bajurko, Ph.D., Assistant Professor
Krzysztof Derzakowski, Ph.D., Assistant Professor
Wojciech Kazubski, Ph.D., Assistant Professor
Jerzy Kołakowski, Ph.D., Assistant Professor
Tomasz Kosiło, Ph.D., Assistant Professor (0.5)
Sebastian Kozłowski, Ph.D., Assistant Professor
Krzysztof Kurek, Ph.D., Assistant Professor
Ryszard Michnowski, Ph.D., Assistant Professor
Mirosław Mikołajewski, Ph.D., Assistant Professor
Juliusz Modzelewski, Ph.D., Assistant Professor
Karol Radecki, Ph.D., Assistant Professor (0.5)
Henryk Chaciński, M.Sc., Senior Lecturer (0.5)
Tomasz Keller, Ph.D., Senior Lecturer (0.33)

Junior academic staff

Grzegorz Bogdan, M. Sc., Assistant (0,5)
Konrad Godziszewski, M.Sc., Assistant (0.5)
Denys Nyzovets, M.Sc., Research Assistant (from Nov. 2016 till Aug. 2019)

Technical staff

Anna Czarnecka, M.Sc., Senior R&D Engineer
Marek Marcinkowski, Senior Foreman (0.75)
Stanisław Żmudzin, M.Sc., Senior R&D Engineer (0.25, till Sept. 2016)

Ph.D. students

Anna Badawika, M.Sc., from Oct. 2013
Łukasz Błaszczyk, M.Sc., from Oct. 2013
Grzegorz Bogdan, M.Sc., from Oct. 2013
Vitomir Djaja-Jośko, M.Sc., from Oct. 2015
Konrad Godziszewski, M.Sc., fromOct. 2010
Marcin Kołakowski, M.Sc., from Oct. 2016
Denys Nyzovets, M.Sc., from Oct. 2016
Przemysław Piasecki, M.Sc., from Oct. 2013

Temporary staff

Denys Nyzovets, M.Sc., Devel. Engineer (from Sept. to Nov. 2016)

Retired

Jan Ebert, Prof. D.Sc.,
Stefan Hahn, Prof. D.Sc.,
Waldemar Kiełek, D.Sc.

The research and teaching activities of the Radiocommunications Division are related to radiocommunication systems and networks, including antennas, signal processing and measurement techniques. The research is focused on analog and digital radio transmission. It includes system design with advanced CAD software, particularly cellular and short range systems, as well as some aspects of electromagnetic compatibility, numerous measurements issues and deep insight into antenna techniques.
The most important research topics include analysis, development and investigation of:

- radiocommunication systems and networks – cellular networks (3G and beyond 3G), short range systems, ad-hoc networks, satellite systems and broadband access networks, MIMO systems, Radio-over-Fiber links, wireless optic systems, energy harvesting devices;
- wireless ultra-wideband systems (UWB) – methods and systems for communication and localization, systems for road safety, microwave imaging systems;
- antennas and propagations – electrodynamics modeling and design of various types of microwave, millimeter, submillimeter and terahertz antennas, including electronically controlled and reconfigurable antennas, photonic antennas, integrated antennas, rectennas, metamaterial based antennas, time-modulated antennas; channel modeling and simulation for MIMO, UWB, and cellular systems;
- measurements – spectrum monitoring methods and systems; channel and antenna including automatic far and near-field measurements of antennas characteristics in time and frequency domain, antenna and channel pulse response, transfer functions of UWB antennas, transient states in reconfigurable antennas;
- material characterization (including ferroelectric) in range up to 500 GHz;
- RF circuits and microwave devices – high-efficiency resonant power amplifiers (class D, DE, E, F and G), linear wide-band HF amplifiers, high-power amplitude modulators, high-efficiency power supplies, power factor correctors, LNA, microwave filters and phase shifters and their applications in radio transmitters, receivers, and industrial electronics;
- digital radio broadcasting systems – MF and HF DRM transmitters and receivers;
- theory of signals and modulations – multidimensional Hilbert transform and its applications, "time-frequency" transformations for RF signal processing, applications of "time-frequency" techniques in audio watermarking;
- environmental, biological and social problems – the influence of radiocommunication systems on a human health and environment as well as on electronic equipment, protection zones planning, radio systems for aid and support of disabled persons.

1.3.5. Television Division

Head of Division

Władysław Skarbek, Prof. D.Sc., Tenured Professor
room: 452, phone: +48 22 2345315
e-mail: W.Skarbek@ire.pw.edu.pl

Senior academic staff

Roman Z. Morawski, Prof. D.Sc., Tenured Professor
Grzegorz Pastuszak, D.Sc., Professor
Andrzej Buchowicz, Ph.D., Assistant Professor
Grzegorz Galiński, Ph.D., Assistant Professor
Krystian Ignasiak, Ph.D., Assistant Professor
Andrzej Miękina, Ph.D., Assistant Professor
Jacek Naruniec, Ph.D., Assistant Professor
Andrzej Podgórski, Ph.D., Assistant Professor
Tomasz Krzymień, M.Sc., Senior Lecturer (0.5)

Junior academic staff

Marek Kowalski, M.Sc., Assistant (0.5)

Ph.D. students

Andrzej Abramowski, M.Sc, from Feb. 2011
Przemysław Buczkowski, M.Sc., from Oct. 2016
Błażej Czupryński, M.Sc., from Oct. 2013
Daniel Grzywczak, M.Sc., from Feb. 2013
Grzegorz Gwardys, M.Sc., from Feb. 2013
Marek Kowalski, M.Sc., from Feb. 2014
Paweł Mazurek, M.Sc., from Feb. 2014
Rafał Protasiuk, M.Sc., from Oct. 2016
Maciej Trochimiuk, M.Sc., from Oct. 2012
Jakub Wagner, M.Sc., from Feb. 2014

Retired

Marek Rusin, Ph.D.

Activities of the Television Division focus on media compression, object recognition in images, and media searching. Moreover, media security, extracting 3D models from video streams, the augmented reality for TV applications, and novel multimedia applications based on deep, convolution, and recurrent artificial neural networks - extend the traditional area of research and teaching in the Television Division.

Digital Processing of Measurement Signals Group is active in the field of measurement science and technology. Its research activities are focused on improving the quality of measurements by means of digital signal processing. The current research topics include:

- general-purpose algorithms for reconstruction of measurands and for calibration of measuring channels;
- portable sound-and-vibration analysers for applications in technical diagnostics and in the environmental monitoring;
- radar-based systems for monitoring of disabled and elderly persons;
- ethical aspects of measurement-based empirical research.

1.4. Evening Studies and Continuing Education

1.4.1. Engineer Degree Evening Studies on Radiocommunications and Multimedia Technology

Kajetana Snopek, D.Sc., Faculty coordinator
room: 443, phone: +48 22 2347713
e-mail: K.Snopek@ire.pw.edu.pl

Tomasz Jamrógiewicz, M.Sc. Organizing coordinator
room: 68, phone: +48 22 2347917
e-mail: T.Jamrogiewicz@ire.pw.edu.pl

Secretariat

Monika Różycka, M.A.
room: 424, phone: +48 22 2347829, +48 22 8255248
fax: +48 22 8255248
e-mail: M.Rozycka@ire.pw.edu.pl

1.4.2. Environmental Noise Protection Course

Head

Ewa Kotarbińska, Ph.D.
room: 131, phone: +48 22 2347644
e-mail: E.Kotarbinska@ire.pw.edu.pl

Secretariat

Joanna Witkowska
room: 66, phone: +48 22 2347955
fax: +48 22 8251363
e-mail: J.Witkowska@ire.pw.edu.pl

1.5. Other Institute's Units

1.5.1 Library

Curator

Teresa Miąsek, M.A. (0.5)
room: 557, phone: +48 22 2347627
e-mail: T.Miasek@ire.pw.edu.pl

1.5.2 Accounting Department

Head

Janina Nowak
room: 420, phone: +48 22 2347645
e-mail: J.Nowak@ire.pw.edu.pl

Staff

Anna Dobrzyńska (0.75)
room: 421, phone: +48 22 2347743
e-mail: A.Dobrzynska@ire.pw.edu.pl

Aleksandra Jefimowicz, M.A.
room: 421, phone: +48 22 2346089
e-mail: A.Jefimowicz@ire.pw.edu.pl

Zdzisława Fenikowska, M.A.
room: 421, phone: +48 22 2347743
e-mail: Z.Fenikowska@ire.pw.edu.pl

1.5.3 Supply Section

Staff

Andrzej Laskowski
room: 419, phone: +48 22 2345018
e-mail: A.Laskowski@ire.pw.edu.pl

Andrzej Skrzypkowski (0.5)
room: 419, phone: +48 22 2345018
e-mail: A.Skrzypkowski@ire.pw.edu.pl

1.5.4 Office of the Fundation for the Development of Radiocommunication and Multimedia Technology

Anna Czarnecka, M.Sc., Senior R&D Engineer
room: 535, phone: +48 22 2347910
e-mail: *A.Czarnecka@ire.pw.edu.pl*

2. STAFF

2.1. Senior academic staff

Paweł Bajurko
room: 34, phone: +48 22 2347795
e-mail: P.Bajurko@ire.pw.edu.pl
M.Sc. (’04), Ph.D. (’12); antennas and antenna arrays; reconfigurable systems, sub-THz techniques, wireless localization; **Assistant Professor**, Radiocommunications Division.
[Edu90]; [Pro9], [Pro15], [Pro16], [Pro31]; [MSc32], [MSc34]; [BSc54]; [Pub59], [Pub79], [Pub96].

Piotr Bilski
room: 127, phone: +48 22 2347644
e-mail: P.Bilski@ire.pw.edu.pl
M.Sc. ('01), Ph.D. ('06), D.Sc. (’14); measurement systems, virtual instrumentation, digital signal processing, diagnostics of analog systems, artificial intelligence; **Professor**, Electroacoustics Division.
Director’s Representative for Public Relations (’16-); Member of IEEE (’05-), POLSPAR Board (’14-), and IMEKO TC10 Board (’12-). Member of the Control Committee of the iUSER Sector Program, National Centre for the Research and Development (’16-). Recipient of a team award of the Rector (’16).
[Edu1], [Edu20], [Edu69]; [Pro13], [Pro30]; [Pub40], [Pub56], [Pub71], [Pub73], [Pub80], [Pub81], [Pub82], [Pub83], [Pub84], [Pub85], [Pub86], [Pub87], [Pub132], [Pub149]; [Pat3], [Pat7].

Piotr Bobiński
room: 125, phone: +48 22 2347637
e-mail: P.Bobinski@ire.pw.edu.pl
M.Sc. ('98), Ph.D. ('04); acoustics, electroacoustics and sound engineering, digital audio signal processing, multimedia and measurement systems, distributed systems and web technology; **Senior Lecturer**, Electroacoustics Division.
[Edu1], [Edu6], [Edu53], [Edu125], [Edu142]; [Pro33]; [MSc28]; [BSc22], [BSc48], [BSc71]; [Pub83], [Pub90], [Pub108], [Pub140], [Pub184], [Pub185], [Pub186], [Pub187], [Pub188], [Pub189], [Pub190]; [Pat3].

Piotr Bogorodzki
room: 70, phone: +48 22 2347345
e-mail: P.Bogorodzki@ire.pw.edu.pl
M.Sc. ('88), Ph.D. ('98), D.Sc. (’12), Prof. (’13); biomedical engineering; **Professor**, Nuclear and Medical Electronics Division.
Member of the Review Board of *IEEE Trans. on Medical Imaging* ('06-); Member of Center of Excellence PROKSIM ('04-); Member of the Associate Editors Board of *International Journal of Electronics and Telecommunications* (’14-); Member of the Programme Board of High Field Resonance Imaging ECOTECH--COMPLEX Center (’15-).
[Edu84]; [Pro10], [Pro20], [Pro32], [Pro41], [Pro46], [Pro47]; [PhD1], [PhD6]; [MSc20]; [BSc9], [BSc15], [BSc57], [BSc62], [BSc73]; [Pub39], [Pub206], [Pub207].

Piotr A. Brzeski
room: 60, phone: +48 22 2347577
e-mail: P.Brzeski@ire.pw.edu.pl
M.Sc. ('70), Ph.D. ('82); biomedical engineering; **Senior Lecturer**, Nuclear and Medical Electronics Division.
Member of the Faculty Council ('90-); Head of the Dean's Financial Committee (’12-); Member of the Faculty Council Committee on Education ('05-); Director’s Representative for Economy & Administration (‘12-); Silver Medal in Commemoration of the 100th Anniversary of WUT (’16).
[Edu8], [Edu9], [Edu21], [Edu73], [Edu74], [Edu75]; [Pro32], [Pro40]; [Pat5].

Andrzej Buchowicz
room: 451, phone: +48 22 2347840
e-mail: A.Buchowicz@ire.pw.edu.pl
M.Sc. ('88), Ph.D. ('97); television, digital signal and image processing, digital television systems; **Assistant Professor**, Television Division.
Member of the Management Board of the Foundation for the Development of Radiocommunications and Multimedia Technology ('02-).
[Edu59], [Edu70], [Edu99], [Edu142]; [Pro13], [Pro24]; [MSc29]; [BSc8]; [Pub42], [Pub190], [Pub191], [Pub192], [Pub193].

Małgorzata Celuch
room: 543, phone: +48 22 2347631
e-mail: M.Celuch@ire.pw.edu.pl
M.Sc. ('88), Ph.D. ('96); microwaves; **Research Assistant**, Microwave and Radiolocation Engineering Division.
[Pro23]; [Pub105], [Pub106].

Henryk Chaciński
room: 433, phone: +48 22 2347841
e-mail: H.Chacinski@ire.pw.edu.pl
M.Sc. ('75); electronics and telecommunications; **Senior Lecturer**, Radiocommunications Division.
[Edu99]; [Pro27]; [BSc77], [BSc79], [BSc80]; [Pub54].

Jacek Cichocki
room: 27, phone: +48 22 2347635,
fax: +48 22 8253759
e-mail: J.Cichocki@ire.pw.edu.pl
M.Sc. ('79), Ph.D. ('92); measurement and instrumentation, radiocommunications, cellular systems; **Reader**, Radiocommunications Division.
Deputy Director for Academic Affairs of the Institute of Radioelectronics and Multimedia Technology (‘12-); Member of the Faculty Council ('02-); Member of the Faculty Council Committee on Education ('08-); Head of the Area of Radiocommunications and Multimedia Technology ('08-); Member of the Programme Committee of the National Conference of Radiocommunications and Broadcasting ('08-); Silver Medal in Commemoration of the 100th Anniversary of WUT (’16).
[Edu12], [Edu42], [Edu47], [Edu102], [Edu104], [Edu105], [Edu121]; [Pro25], [Pro38]; [MSc17]; [BSc18]; [Pub44].

Krzysztof Derzakowski
room: 550, phone: +48 22 2347933
e-mail: K.Derzakowski@ire.pw.edu.pl
M.Sc. ('84), Ph.D. ('91); radio-frequency engineering, microwave technique; **Assistant Professor**, Radiocommunications Division.
[Edu10], [Edu28]; [Pro9], [Pro15], [Pro16], [Pro26], [Pro31]; [BSc65].

Grzegorz Domański
room: 61, phone: +48 22 2347626
e-mail: G.Domanski@ire.pw.edu.pl
M.Sc. ('94), Ph.D. ('01); nuclear and medical electronics; **Assistant Professor**, Nuclear and Medical

Electronics Division.
Faculty Coordinator of Radiological Protection ('02-); Tutorial assistance of Biomedical and Nuclear Engineering Students Scientific Group ('13-).
[Edu49]; [Pro4], [Pro5], [Pro6], [Pro32], [Pro34]; [MSc2], [MSc19], [MSc43]; [BSc34], [BSc56], [BSc63]; [Pub17], [Pub152], [Pub153], [Pub181].

Michał Dziewiecki
room: 63, phone: +48 22 2343660
e-mail: M.Dziewiecki@ire.pw.edu.pl
M.Sc. ('05), Ph.D. ('13); nuclear and medical electronics; **Assistant Professor**, Nuclear and Medical Electronics Division.
[Edu31], [Edu100]; [Pro1], [Pro4], [Pro5], [Pro6], [Pro32]; [BSc59]; [Pub3], [Pub4], [Pub5], [Pub6], [Pub7], [Pub8], [Pub9], [Pub10], [Pub11], [Pub17], [Pub152], [Pub153], [Pub181].

Grzegorz Galiński
room: 451, phone: +48 22 2345016
e-mail: G.Galinski@ire.pw.edu.pl
M.Sc. (97'), Ph.D. ('03); image and video processing, multimedia systems, multimedia indexing; **Assistant Professor**, Television Division.
[Edu13], [Edu70], [Edu115], [Edu142]; [Pro13], [Pro24]; [BSc29], [BSc75]; [Pub194], [Pub195], [Pub196], [Pub201], [Pub202].

Daniel Gryglewski
room: 549, phone: +48 22 2345886
e-mail: D.Gryglewski@ire.pw.edu.pl
M.Sc. ('96), Ph.D. ('01); microwave technique; **Assistant Professor**, Microwave and Radiolocation Engineering Division.
[Edu56], [Edu95], [Edu106]; [Pro7], [Pro12], [Pro14], [Pro23], [Pro50]; [MSc6]; [Pub25], [Pub95], [Pub102], [Pub103], [Pub104], [Pub151].

Wojciech K. Gwarek
room: 544, phone: +48 22 2347725
e-mail: W.Gwarek@ire.pw.edu.pl
M.Sc. ('70; '74 at MIT), Ph.D. ('77), D.Sc. ('88), Prof. Title ('00); electronics; **Tenured Professor**, Microwave and Radiolocation Engineering Division, Head ('06-).
Fellow Member of IEEE ('00-); Member of the Review Board of *IEEE Trans. on Microwave Theory and Techniques* ('88-), *IEEE Trans. on Antennas and Propagation* ('96-), *IEEE Microwave & Wireless Components Letters* ('96-); Member of the International Microwave Conf. MIKON ('93-); Chair of the Faculty Awards Committee and Member of the University Awards Committee ('08-'16); Member of the Electronics and Telecommunication Committee of the Polish Academy of Sciences and Chairman of Section of Microwaves and Radiolocation of that Comm. ('12-); Member of the Scientific Board at the Institute of Electron Technology ('15-); Member of the MIKON Foundation Council ('15-); Silver Medal in Commemoration of the 100th Anniversary of WUT ('16); Recipient of an individual award of the Rector ('16).
[Edu21], [Edu27], [Edu68], [Edu74], [Edu75]; [Pro7], [Pro11], [Pro23]; [Pub20], [Pub21], [Pub26], [Pub36], [Pub72], [Pub103], [Pub104], [Pub105], [Pub106], [Pub120], [Pub147], [Pub148].

Krystian Ignasiak
room: 451, phone: +48 22 2345016
e-mail: K.Ignasiak@ire.pw.edu.pl
M.Sc. ('94), Ph.D. ('99); informatics, multimedia systems, distributed systems, web technology; **Assistant Professor**, Television Division.
[Edu24], [Edu40], [Edu110], [Edu142]; [Pro24]; [MSc50]; [BSc6], [BSc20], [BSc30], [BSc39], [Pub203].

Tomasz Jamrógiewicz
room: 68, phone: +48 22 2347917
e-mail: T.Jamrogiewicz@ire.pw.edu.pl
M.Sc. ('72); nuclear and medical electronics; **Senior Lecturer**, Nuclear and Medical Electronics Division.
Member of Technical Committees for Standardization: TC 173 – Interfaces and Building Electronic Systems ('94-), Member of the Presidium of Polish CAMAC Committee ('89-); Engineer Degree Evening Studies on Radiocommunications – organizing coordinator ('02-).
[Edu31], [Edu57], [Edu114]; [Pro32].

Wojciech Kazubski
room: 427, phone: +48 22 2347378
e-mail: W.Kazubski@ire.pw.edu.pl
M.Sc. ('86), Ph.D. ('98); radio frequency engineering, radio receivers, RF measurement techniques, short-wave propagation; **Assistant Professor**, Radiocommunications Division.
[Edu4], [Edu126]; [Pro27]; [BSc78], [BSc81], [BSc82]; [Pub66].

Jerzy Kołakowski
room: 27, phone: +48 22 2347635,
fax: +48 22 8253759
e-mail: J.Kolakowski@ire.pw.edu.pl
M.Sc. ('88), Ph.D. ('00); ultrawideband systems, cellular systems, measurement and instrumentation; **Assistant Professor**, Radiocommunications Division.
Member of the Management Board of the Foundation for the Development of Radiocommunications and Multimedia Technology ('02-).
[Edu18], [Edu61], [Edu92]; [Pro25], [Pro38]; [BSc16], [BSc43]; [Pub43], [Pub44], [Pub51], [Pub69], [Pub98], [Pub99], [Pub113], [Pub114].

Bogumił Konarzewski
room: 64, phone: +48 22 2347916
e-mail: B.Konarzewski@ire.pw.edu.pl
M.Sc. ('91), Ph.D. ('98); nuclear and medical electronics; **Assistant Professor**, Nuclear and Medical Electronics Division.
Director's Representative for Software and Computer Devices ('16-).
[Edu2], [Edu10], [Edu96]; [Pro4], [Pro5], [Pro6], [Pro32]; [MSc4], [MSc48]; [BSc7]; [Pub17], [Pub152], [Pub153], [Pub181].

Paweł Kopyt
room: 546, phone:+48 22 2345829
e-mail: P.Kopyt@ire.pw.edu.pl
M.Sc. ('01), Ph.D. ('06), microwave technique, modeling of multiphysics effects involving electromagnetic phenomena; **Assistant Professor**, Microwave and Radiolocation Engineering Division.
[Edu77]; [Pro3], [Pro11], [Pro17], [Pro19], [Pro23], [Pro42], [Pro49]; [BSc3], [BSc51]; [Pub16], [Pub19], [Pub20], [Pub21], [Pub26], [Pub36], [Pub94], [Pub110], [Pub118], [Pub119], [Pub120], [Pub133], [Pub155], [Pub156]; [Pat2].

Przemysław Korpas
room: 542, phone: +48 22 2347624
e-mail: P.Korpas@ire.pw.edu.pl
M.Sc. ('10), Ph.D. ('15); microwave technique; **Assistant Professor**, Microwave and Radiolocation Engi-

neering Division.
[Pro14], [Pro23]; [Pub95], [Pub151].

Tomasz Kosiło
room: 434, phone: +48 22 2347576
e-mail: T.Kosilo@ire.pw.edu.pl
M.Sc. ('70), Ph.D. ('77); radiocommunications; **Assistant Professor**, Radiocommunications Division.
Member of the Polish National Committee of the URSI ('02-); member of the Polish Standardization Technical Com. for Audio and Video Devices (’14 -’16).
[Edu46], [Edu71], [Edu103], [Edu119], [Edu120], [Edu142]; [Pro14], [Pro27]; [Pub46], [Pub57], [Pub197].

Ewa Kotarbińska
room: 127, phone: +48 22 2347644
e-mail: E.Kotarbinska@ire.pw.edu.pl
M.Sc. ('73), Ph.D. ('81); acoustics, noise control, environmental acoustics; **Assistant Professor**, Electroacoustics Division.
Member of the Polish Acoustics Society ('73-); Member of the European Acoustics Society ('02-).
[Edu35], [Edu130]; [Pro33]; [MSc11]; [Pub47], [Pub121].

Sebastian Kozłowski
room: 444, phone: +48 22 2346088
e-mail:S.Kozlowski@ire.pw.edu.pl
M.Sc. (‘04), Ph.D. (‘11); MIMO systems, **Assistant Professor**, Radiocommunications Division.
[Edu79]; [Pro15], [Pro16], [Pro29]; [MSc18]; [BSc40]; [Pub24], [Pub37]; [Pat4].

Marek Krawczyk
room:538, phone: +48 22 2347641
e-mail: M.Krawczyk@ire.pw.edu.pl
MD in Medical Sciences (’69), PhD in Medical Sciences (’75), D.Sc. in Medical Sciences (‘87), Prof. Title (’95); general surgery specialization, clinical transplantology specialization, oncological surgery specialization; **Professor**, Nuclear and Medical Electronics Division
Rector of the Medical University of Warsaw (’08-‘16), Head of the Department of General, Transplant and Liver Surgery (’98-‘16), President of the Conference of Rectors of Warsaw’s Universities (‘12-‘16), European Expert in the Hepato-Pancreatic-Biliary Surgery FEBS (’13-), Corresponding Member of the Polish Academy of Sciences – PAN (’07-), Corresponding Member of the Polish Academy of Arts and Sciences (’14-), Member of the French Academy of Surgery (*’99-),* President of the European Surgical Association (‘16-‘17), Member of the European Board of Surgery (FEBS) within Hepato-Pancreatic-Biliary Surgery and the Examination Board of the HPB Surgery Division (’13-), Honorary Member of the French Society for Surgery (’06-), Germany (’07-), Romania (’07-), Czech Republic (08’), Bulgaria (’14-), National Chapter for Serbia and Montenegro of the IHPBA (’05-), The Romanian Association of Hepato-Pancreatic – Biliary Surgery and Liver Transplantation (’15-), Honorary Member of the Polish Urological Society (’09-) and its Endourology Section (’12-), the Polish Transplant Society (’13-), the Polish Society of Oncological Surgery (’13-) and the Videosurgery Section of the Association of Polish Surgeons (’14-), Member of the Editorial Committee of *HPB Surgery: The Official Journal of the International Hepato-Pancreato-Biliary Association* and *Hepatogastroenterology,* Head of the Council of Institute of Contemporary Civilization Problems (’12-‘16); Recipient of the Commander’s Cross of the Order of Polonia Restituta (‘16).

Tomasz Krzymień
room: 11a, phone: +48 503510402
e-mail: T.Krzymien@ire.pw.edu.pl
M.Sc. (‘86); television; **Senior Lecturer**, Television Division.
Director’s Representative for Occupational Safety and Health (’08-).

Zbigniew Kulka
room: 132, phone: +48 22 2347621
e-mail: Z.Kulka@ire.pw.edu.pl
M.Sc. ('67), Ph.D. ('80), D.Sc. ('96), Prof Title (‘13); analog electronics, a/d and d/a converters, digital audio; **Professor**, Electroacoustics Division.
Secretary of the Board of the Foundation for the Development of Radiocommunications and Multimedia Technology ('01-‘16); Member of the Management Board of the Polish Section of the Audio Engineering Society ('01-); Associate Editor of *Archieves of Acoustics,* Quarterly of the Polish Academy of Science (’14-); Bronze Medal in Commemoration of the 100th Anniversary of WUT (’16), Recipient of an individual and a team award of the Rector (’16).
[Edu65], [Edu72], [Edu74], [Edu75], [Edu140], [Edu141]; [Pro33]; [BSc19].

Krzysztof Kurek
room: 551, phone: +48 22 2345476
e-mail: K.Kurek@ire.pw.edu.pl
M.Sc. ('96), Ph.D. ('02); radiocommunications, radio-frequency engineering, space technologies; **Assistant Professor**, Radiocommunications Division.
Tutorial assistance of Space Engineering Student Scientific Group ('04-); Member of the Committee on Space Research of the Polish Academy of Sciences ('07-).
[Edu12], [Edu51], [Edu98]; [Pro26], [Pro35]; [BSc76]; [Pub37], [Pub62], [Pub122].

Robert Kurjata
room: 61, phone: +48 22 2347626
e-mail: R.Kurjata@ire.pw.edu.pl
M.Sc. ('00), Ph.D. ('07); nuclear and medical electronics; **Assistant Professor**, Nuclear and Medical Electronics Division.
Dean’s Representative in charge of Information Systems (‘12-).
[Edu7], [Edu57], [Edu91], [Edu94], [Edu111], [Edu118]; [Pro4], [Pro5], [Pro6], [Pro32]; [MSc10], [MSc36]; [BSc12], [BSc45], [BSc60], [BSc61]; [Pub3], [Pub4], [Pub5], [Pub6], [Pub7], [Pub8], [Pub9], [Pub10], [Pub11], [Pub12], [Pub17], [Pub152], [Pub153], [Pub181].

Marcin Lewandowski
room: 125, phone: +48 22 2347637
e-mail: M.Lewandowski@ire.pw.edu.pl
M.Sc. (‘06), Ph.D. ('13); acoustics, electroacoustics and sound engineering, digital audio signal processing, digital sound synthesis; **Assistant Professor**, Electroacoustics Division.
Recipient of a team award of the Rector (’16).
[Edu58]; [Pro33], [Pro37]; [BSc17], [BSc24], [BSc36], [BSc41]; [Pub108], [Pub129], [Pub140].

Robert Łukaszewski
room: 440, phone: +48 22 2347340
e-mail: R.Lukaszewski@ire.pw.edu.pl
M.Sc. ('97), Ph.D. ('07); measurement and instrumen-

tation; **Assistant Professor**, Electroacoustics Division. Recipient of a team award of the Rector (’16).
[Edu76]; [Pro9], [Pro13], [Pro30]; [MSc9]; [BSc49]; [Pub90], [Pub122]; [Pat3], [Pat7].

Grzegorz Makarewicz
room: 130, phone: +48 22 2347748
e-mail: G.Makarewicz@ire.pw.edu.pl
M.Sc. ('80), Ph.D. ('93); acoustics, mechanical vibrations, active noise and vibration control, tube audio devices, digital signal processing; **Assistant Professor**, Electroacoustics Division.
[Edu16], [Edu133]; [Pro21], [Pro33]; [BSc5], [BSc28]; [Pub48], [Pub130], [Pub131].

Janusz Marzec
room: 63, phone: +48 22 2347643
e-mail: J.Marzec@ire.pw.edu.pl
M.Sc. ('75), Ph.D. ('83), D.Sc. ('03); nuclear and medical electronics, HEP detectors and front-end electronics; **Professor**, Nuclear and Medical Electronics Division.
Member of the University Disciplinary Committee of Appeal ('08-‘16). Member of the University Disciplinary Committee for Academic Staff (’16-). Member of the High Energy Physics Experiments Platform, WUT (’14-).
[Edu17], [Edu21], [Edu45], [Edu74], [Edu75], [Edu88]; [Pro4], [Pro5], [Pro6], [Pro32]; [PhD4]; [MSc13], [MSc26], [MSc40]; [Pub9], [Pub10], [Pub11], [Pub12], [Pub17], [Pub152], [Pub153], [Pub181].

Przemysław Miazga
room: 500, phone: +48 22 2347878
e-mail: P.Miazga@ire.pw.edu.pl
M.Sc. ('80), Ph.D. ('89); microwaves, computer engineering, measurements; **Assistant Professor**, Microwave and Radiolocation Engineering Division.
Tutorial assistance of Innovative Information Technologies Student Scientific Group ('05-).
[Edu19], [Edu25], [Edu78]; [Pro18], [Pro23].

Ryszard Michnowski
room: 27, phone: +48 22 2347635
e-mail: R.Michnowski@ire.pw.edu.pl
M.Sc. ('97), Ph.D. ('06), measurement and instrumentation, radiocommunications, microwave technique; **Assistant Professor**, Radiocommunications Division.
[Pro25], [Pro38]; [MSc14]; [BSc69]; [Pub44], [Pub45], [Pub64].

Andrzej Miękina
room: 439, phone: +48 22 2347346
e-mail: A.Miekina@ire.pw.edu.pl
M.Sc. ('85), Ph.D. ('98); measurement and instrumentation; **Assistant Professor**, Television Division.
[Edu29], [Edu37], [Edu38], [Edu116]; [Pro9], [Pro28]; [Pub27], [Pub28], [Pub134], [Pub135], [Pub136], [Pub161], [Pub169], [Pub170].

Mirosław G. Mikołajewski
room: 539, phone: +48 22 2347724
e-mail: M.Mikolajewski@ire.pw.edu.pl
M.Sc. ('87), Ph.D. ('93); radio-frequency engineering, power electronics, radio transmitters, switch-mode power supplies; **Assistant Professor**, Radiocommunications Division.
[Edu23]; [Pro27]; [BSc66]; [Pub49], [Pub137].

Józef W. Modelski
room: 535a, phone: +48 22 2347723
e-mail: J.Modelski@ire.pw.edu.pl
M.Sc. ('73), Ph.D. ('78), D.Sc. ('87), Prof. Title ('94), Honoris Causa Doctorates from: the Military University of Technology (‘11), and the Lodz University of Technology (’14); radio-frequency engineering, microwave techniques; **Tenured Professor**, Radiocommunications Division.
Director of the Institute of Radioelectronics and Multimedia Technology ('96-‘16); President of URSI National Committee (‘12-); Member of the National Committee for Co-operation with the International Council of Science (’12-), member of the Scientific and Industrial Council at the State Secretary in Ministry of Defence (’14-); Chairman of the Committee on Electronics and Telecommunications PAN ('07-); Member of the Committee on Space and Satellite Research PAN ('01-); Associated Member of the Ukrainian National Academy of Sciences ('99-); Member of Scientific Councils: National Institute of Telecommunications ('03-), Military Communication Institute (’10-), Space Research Centre PAN (’11-); Chairman of the MIKON Foundation Council (’15-); President of the Foundation for the Development of Radiocommunications and Multimedia Technology ('00-); Member of Editorial Board of *IEEE Transactions on MTT* ('95-); Chairman of the Microwave and Radar Week (’04-); TPC Member of the IEEE MTT-S International Microwave Symposium ('95- and European Microwave Conference (’01-); Chair of the Programme Council of the International Conference the Polish Chamber for Electronic Communication (’05-); Corresponding Member of the Polish Academy of Sciences – PAN (’07-); Fellow Member of IEEE (’01-); University Senate Elected Member ('05-‘16); Golden Graduates’ Book of WUT (’15); Chair of the Faculty Council Committee on Awards (’16-).
[Edu74], [Edu75], [Edu142]; [Pro14], [Pro26]; [Pub58], [Pub70], [Pub77], [Pub138], [Pub151].

Juliusz S. Modzelewski
room: 537, phone: +48 22 2347793
e-mail: J.Modzelewski@ire.pw.edu.pl
M.Sc. ('77), Ph.D. ('93); radio-frequency engineering, power electronics, radio transmitters; **Assistant Professor**, Radiocommunications Division.
Member of ISCAS Review Committee ('06-); Reviewer of *IEEE Transactions on Power Electronics* (’14-‘16), Reviewer of *Przegląd Elektrotechniczny* (’15-16). Medal of National Education Committee (’16).
[Edu4], [Edu126]; [Pro27]; [BSc74]; [Pub50], [Pub139].

Roman Z. Morawski
room: 445, phone: +48 22 2347721
e-mail: R.Morawski@ire.pw.edu.pl
M.Sc. ('72), Ph.D. ('79), D.Sc. ('90), Prof. Title ('01); measurement and instrumentation; **Tenured Professor**, Television Division.
POLSPAR Representative in the General Council of International Measurement Confederation IMEKO (‘98-); Member of the IMEKO Advisory Board ('06-); Member of the Editorial Board of the journal *Measurement* ('97-); Member of the Editorial Board of the journal *Technisches Messen* (’15-); Reviewer of several *IEEE* and *Elsevier* journals ('00-); Member of the Senate Committee on Professional Ethics ('12-), Member of the State Committee on Academic Staff (’16-). Honorary Senior Fellow of City University of London ('10-); Chair of the Faculty Council Committee on Academic Staff Development (’16-). Member of the Jury of the WUT Medal for Young Scientist (’08-).

Silver Medal in Commemoration of the 100th Anniversary of WUT ('16).
[Edu26], [Edu29], [Edu37], [Edu38], [Edu86]; [Pro9], [Pro28]; [Pub27], [Pub28], [Pub134], [Pub135], [Pub136], [Pub169], [Pub170].

Krzysztof Mroczek
room: 441, phone: +48 22 2347946
e-mail: K.Mroczek@ire.pw.edu.pl
M.Sc. ('95), Ph.D. ('02); measurement and instrumentation, programmable logic devices, system a-programmable-chip (SoPC); **Assistant Professor**, Electroacoustics Division.
[Edu22]; [Pro30].

Jacek Naruniec
room: 11, phone: +48 22 2347332
e-mail: J.Naruniec@ire.pw.edu.pl
M.Sc. ('06), Ph.D. ('10); multimedia systems, video processing; **Assistant Professor**, Television Division.
Tutorial assistance: Students' Scientific Group of Web Application ('15-).
[Edu39], [Edu81]; [Pro24]; [BSc1], [BSc23], [BSc33], [BSc37], [BSc42]; [Pub23], [Pub29], [Pub179]; [Pat6].

Tomasz Olszewski
room: 58, phone: +48 22 2347577
e-mail: T.Olszewski@ire.pw.edu.pl
M.Sc. ('82); nuclear and medical electronics, capacitance tomography, digital electronics, programmable logic devices; **Senior Lecturer**, Nuclear and Medical Electronics Division.
[Edu22]; [Pro32], [Pro40]; [BSc2], [BSc27], [BSc72]; [Pub157], [Pub158]; [Pat5].

Grzegorz Pastuszak
room: 451; phone: +48 22 2347840
e-mail: G.Pastuszak@ire.pw.edu.pl
M.Sc. ('01), Ph.D. ('06), D.Sc. ('15); integrated circuits design, multimedia systems, video processing; **Associate Professor**, Television Division.
Recipient of an individual award of the Rector ('16).
[Pro48]; [MSc1]; [Pub30], [Pub31], [Pub32], [Pub33], [Pub93], [Pub112], [Pub141].

Ewa Piątkowska-Janko
room: 69, phone: +48 22 2347918
e-mail: E.Piatkowska@ire.pw.edu.pl
M.Sc. ('78), Ph.D. ('01); medical and nuclear engineering; **Assistant Professor**, Nuclear and Medical Electronics Division.
Tutorial assistance of Beskid Mountain Guides Student Circle (-99'). Medal of National Education Committee ('16). Medal of Education Committee ('16).
[Edu31]; [Pro10], [Pro20], [Pro32], [Pro41], [Pro46], [Pro47]; [MSc49]; [BSc52]; [Pub39], [Pub206].

Piotr Płoński
room: 74 , phone: +48 22 2347739
e-mail: P.Plonski@ire.pw.edu.pl
M.Sc. ('10), Ph.D. ('16), biomedical engineering, nuclear electronics; **Assistant Professor**, Nuclear and Medical Electronics Division.
[Pro6], [Pro8]; [PhD3]; [Pub3].

Andrzej Podgórski
room: 431, phone: +48 22 2345453
e-mail: A.Podgorski@ire.pw.edu.pl
M.Sc. ('75), Ph.D. ('83); measurement and instrumentation; **Assistant Professor**, Television Division.
Golden Medal for the Long-lasting Service ('16).
[Edu11], [Edu29], [Edu37], [Edu38], [Edu123]; [Pro28]; [BSc46]; [Pub55].

Karol W. Radecki
room: 29, phone: +48 22 2347620
e-mail: K.Radecki@ire.pw.edu.pl
M.Sc. ('70), Ph.D. ('78); radio-frequency engineering and measurement; **Assistant Professor**, Radiocommunications Division.
Member of the National Committee of URSI ('90-); Member of the Scientific Advisory Board, Polish Association for the Blind ('95-).
[Edu112], [Edu124]; [Pro25]; [Pub46], [Pub57].

Dariusz Radomski
room: 4, phone: +48 22 2345017
e-mail: D.Radomski@ire.pw.edu.pl
M.Sc. ('96), Ph.D. (automatics and robotics '01), Ph.D. (medical science '06); mathematical modeling of physiological and disease processes, biostatistical methods, experiments design methods; **Research Assistant Professor**, Nuclear and Medical Electronics Division.
[Pro32]; [Pub35].

Stanisław Rosłoniec
room: 552, phone: +48 22 2347956
e-mail: S.Rosloniec@ire.pw.edu.pl
M.Sc. ('72), Ph.D. ('76), D.Sc. ('91), Prof. Title ('01), microwave technique; **Tenured Professor**, Microwave and Radiolocation Engineering Division.
[Edu5], [Edu93]; [Pro23].

Dawid Rosołowski
room: 542, phone: +48 22 2347624
e-mail: D.Rosolowski@ire.pw.edu.pl
M.Sc. ('05), Ph.D. ('12); microwave technique; **Assistant Professor**, Microwave and Radiolocation Engineering Division.
[Edu22], [Edu108]; [Pro7], [Pro14], [Pro23]; [Pub95], [Pub103], [Pub151].

Tymon Rubel
room: 74, phone: +48 22 2347739
e-mail: T.Rubel@ire.pw.edu.pl
M.Sc. ('03), Ph.D. ('10); medical and nuclear engineering; **Assistant Professor**, Nuclear and Medical Electronics Division.
[Edu83], [Edu113]; [MSc44], [MSc45]; [BSc31]; [Pub22], [Pub76].

Bartłomiej Salski
room: 547, phone: +48 22 2347622
e-mail: B.Salski@ire.pw.edu.pl
M.Sc. ('06), Ph.D. ('10), D.Sc. ('15); microwave technique; **Associate Professor**, Microwave and Radiolocation Engineering Division.
Member of CLEO ('14-), Reviewer of journals: *IEEE Trans. on Antennae and Propag.* ('10-), *Micro. Theory and Techniques* ('10-), *IEEE Micro. & Wireless Compon. Letters* ('12-); Member of Sect. of Microwes and Radiolocation of the Electronics and Telecommunication Comm. of the Polish Academy of Sciences ('15-); Founder and President of the Board Council of the Microwave and Radiolocation Foundation ('15-); Tutorial assistance of Electromagnetic Modelling Students Scientific Group ('16-); Recipient of the Polish Academy of Sciences Award, and an individual award of the Rector ('16).
[Edu27], [Ed43]; [Pro17], [Pro23], [Pro36], [Pro49]; [BSc13], [BSc47]; [Pub18], [Pub19], [Pub20], [Pub21], [Pub26], [Pub36], [Pub38], [Pub110], [Pub111], [Pub118], [Pub119], [Pub120], [Pub154], [Pub155], [Pub156].

Błażej Sawionek
room: 68, phone: +48 22 2346086
e-mail: B.Sawionek@ire.pw.edu.pl
M.Sc. (‘91), Ph.D. (’99); medical and nuclear engineering; **Assistant Professor** (0.5), Nuclear and Medical Electronics Division.
[Edu15]; [Pro32]; [MSc15]; [BSc10], [BSc67]; [Pub39].

Władysław Skarbek
room: 452, phone: +48 22 2345315
e-mail: W.Skarbek@ire.pw.edu.pl
M.Sc. ('72), Ph.D. ('77), D.Sc. ('94); Prof. Title ('03); information technology, image processing, digital media; **Tenured Professor**, Television Division, Head ('00-).
Member of the Editorial Board of *Fundamenta Informaticae* (‘03-), *International Journal of Electronics and Telecommunication* (‘13-); Silver Medal in Commemoration of the 100th Anniversary of WUT (’16).
[Edu62], [Edu63], [Edu85], [Edu142]; [Pro24]; [PhD5]; [MSc30]; [Pub58], [Pub70], [Pub190], [Pub191], [Pub192], [Pub193], [Pub194], [Pub195], [Pub196], [Pub198], [Pub199], [Pub200], [Pub201], [Pub2012], [Pub203].

Waldemar Smolik
room: 5, phone: +48 22 2345786
e-mail: W.Smolik@ire.pw.edu.pl
M.Sc. ('91), Ph.D. ('97), D.Sc. (’14); computer engineering, biomedical engineering, computer tomography; **Associate Professor**, Nuclear and Medical Electronics Division.
International Board Member of IEEE International Conf. on Imaging Systems and Techniques (’09); Member of the Faculty Council Committee on Education ('16-); Recipient of an individual award of the Rector (’16).
[Edu44], [Edu66], [Edu82]; [Pro32], [Pro39], [Pro40]; [MSc39], [MSc47]; [Pub123], [Pub124], [Pub125], [Pub157], [Pub158], [Pub177], [Pub178]; [Pat5].

Kajetana Snopek
room: 443, phone: +48 22 2347713
e-mail: K.Snopek@ire.pw.edu.pl
M.Sc. ('91), Ph.D. ('02), D.Sc. (’14); signal and system theory and applications; **Associate Professor**, Radiocommunications Division.
Faculty Coordinator of Evening Studies on Radiocommunications ('05-); Secretary of the Board of the Foundation for the Development of Radiocommunications and Multimedia Technology (’16-); Member of the Programme Committee of *39th International Conference on Telecommunications and Signal Procesing* (’16-).
[Edu54], [Edu55], [Edu124]; [Pro14], [Pro29]; [MSc46]; [Pub1], [Pub13], [Pub77].

Maciej Sypniewski
room: 541, phone: +48 22 2347347
e-mail: M.Sypniewski@ire.pw.edu.pl
M.Sc. ('83), Ph.D. ('96); microwave technique; **Assistant Professor**, Microwave and Radiolocation Engineering Division.
[Edu41]; [Pro23]; [Pub60], [Pub106].

Roman Szabatin
room: 60, phone: +48 22 2347577
e-mail: R.Szabatin@ire.pw.edu.pl
M.Sc. ('70), Ph.D. ('82); biomedical engineering; **Assistant Professor**, Nuclear and Medical Electronics Division.
[Edu31], [Edu36], [Edu89]; [Pro32], [Pro40]; [MSc23]; [BSc4], [BSc70]; [Pub157], [Pub158]; [Pat5].

Wiesław Winiecki
room: 442, phone: +48 22 2347341
e-mail: W.Winiecki@ire.pw.edu.pl
M.Sc. ('75), Ph.D. ('86), D.Sc. ('03); Prof. Title ('11); measurement and instrumentation; **Professor**, Electroacoustics Division.
Deputy Director for Research of the Institute of Radioelectronics and Multimedia Technology ('08-‘16); Director of the Institute of Radioelectronics and Multimedia Technology (’16-);
Member of the Metrology and Instrumentation Comittee, Polish Academy of Sciences ('07-'16); Chairman of the Rector Committee on Research and Scientific Instrumentation (’12-); Vice-president of POLSPAR (’11-), Chairman of Measurement Committee of POLSPAR (’04-) Member of the Scientific and Programme Committee of the National Conferences: Measurement Systems in the Scientific Research and Industry ('01-), Dynamic Measurements ('06-), Fundamental Problems of Metrology ('09-), and International Conference IEEE on Intelligent Data Acquisition and Advanced Computing Systems IDAACS ('01-); Member of the IEEE IDAACS International Advisory Board ('09-), Reviewer of the IEEE Transactions on Instrumentation and Measurement ('03-), Metrology and Measuring Systems (07-), Member of the Editorial Board of the *International Journal of Computing* ('06-); Member of Programme Board of the Journal *Pomiary Automatyka Kontrola* ('07-); Silver Medal in Commemoration of the 100th Anniversary of WUT (’16); Recipient of an individual and a team awards of the Rector (’16).
[Edu1], [Edu30], [Edu76], [Edu97], [Edu101]; [Pro9], [Pro13], [Pro30]; [PhD2], [PhD7]; [Pub65], [Pub84], [Pub85], [Pub86], [Pub122], [Pub135], [Pub169], [Pub173], [Pub174], [Pub175]; [Pat3], [Pat7].

Wojciech Wojtasiak
room: 549, phone: +48 22 2345886
e-mail: W.Wojtasiak@ire.pw.edu.pl
M.Sc. ('84), Ph.D. ('98), D.Sc. (’15); microwave technique; **Associate Professor**, Microwave and Radiolocation Engineering Division, Member of IEEE (’96-); Member of the International Microwave Conf. MIKON (2016-), Bronze Medal of the 100 Years of the Revival of the WUT (’16).
[Edu32]; [Pro7], [Pro12], [Pro14], [Pro23], [Pro50]; [MSc16]; [Pub34], [Pub61]; [Pub72], [Pub95], [Pub103], [Pub104], [Pub109], [Pub127], [Pub147], [Pub148], [Pub151], [Pub164], [Pub165], [Pub166].

Yevhen Yashchyshyn
room: 33, phone: +48 22 2347727
e-mail: E.Jaszczyszyn@ire.pw.edu.pl
M.Sc. ('79), Ph.D. ('86), D.Sc. ('06), Prof. Title (’16); telecommunications; **Professor**, Radiocommunications Division, Head ('09-‘16).
Deputy Director for Research of the Institute of Radioelectronics and Multimedia Technology (’16-);
Member of the Organizing Committee of the International Conference *TCSET- Modern Problems of Radio Engineering, Telecommunications and Computer Science* ('98-); Reviewer of the *IEEE Transactions on Microwave Theory and Techniques* ('04-), *IEEE Transactions on Antennas and Propagation* ('06-) and *IEEE Microwave and Wireless Components Letters* ('04-); Member of Editorial Board of *Izwestiya Wuzow Radioelektronika* ('09-); Member of the Microwave

and Radiolocation Section of the Electronics and Telecommunication Committee of the Polish Academy of Sciences ('07-); TPC Member of the MIKON ('09-), TPC Member of the European Wireless Conference EW ('10-), Member of the Programme Committee of the National Conference of Radiocommunications and Broadcasting ('09-); Member of the Faculty Council Committee on Scientific Researches (’16-); Bronze Medal in Commemoration of the 100th Anniversary of WUT.
[Edu3], [Edu21], [Edu64]; [Pro2], [Pro9], [Pro15], [Pro16], [Pro20], [Pro31], [Pro44], [Pro45]; [Prof1]; [MSc12], [MSc25], [MSc33], [MSc41], [MSc42]; [Pub14], [Pub63], [Pub67], [Pub74], [Pub75], [Pub91], [Pub92], [Pub100], [Pub143], [Pub144], [Pub163]; [Pat1].

Krzysztof Zaremba
room: 72, phone: +48 22 2347955, +48 22 2347497
e-mail: K.Zaremba@ire.pw.edu.pl
M.Sc. ('81), Ph.D. ('90), D.Sc. ('03), Prof. Title (’12), Tenured Prof. (’14); biomedical engineering, nuclear electronics; **Tenured Professor**, Dean of the Faculty (’12-); Nuclear and Medical Electronics Division, Head ('03-).
Member of CERN ('89-); Member (’05-) and Vice-chairman of the University Council Committee on Property and Finances ('12-); Member of the Programme Board of the Institute of Applied Researches, WUT (’14-); Member of the Scientific Board of Inter. Forum on Innovative Technologies for Medicine ITMED (‘07-), Member of the Editorial Advisory Board of the *Polish Journal of Medical Physics and Engineering* (‘07-), Head of the Specialization *Electronics and Information Technology in Medicine* ('06-); Deputy Chairman of the Board of the Center for Imaging and Biomedical Research ('06-); Member of the Board of Polish Eastern Medical Cluster ('08-), Member of the Scientific Board of the National Centre for Nuclear Nuclear Research (’15-); Member of the Scientific Board of the Nałęcz Institute of Biocybernetics and Biomedical Engineering, Polish Academy of Science (’15-); Member of the Committee on Biocybernetics and Biomedical Engineering Polish Academy of Science (’16-); Member of the Ministerial Team for Financial Systems of Higher Education and Science (’16-). Recipient of an individual award of the Rector (’16).
[Edu50], [Edu74], [Edu75], [Edu87]; [Pro1], [Pro4], [Pro5], [Pro6], [Pro8], [Pro32]; [PhD3]; [Pub3], [Pub4], [Pub5], [Pub6], [Pub7], [Pub8], [Pub9], [Pub10], [Pub11], [Pub12], [Pub17], [Pub152],[Pub153], [Pub181].

Jan Żera
room: 131, phone: +48 22 2347999
e-mail: J.Zera@ire.pw.edu.pl
M.Sc. ('76), Ph.D. ('90), D.Sc. ('04); acoustics, electroacoustics, psychoacoustics, noise control; **Professor**, Electroacoustics Division, Head (-’13).
Member of Polish Acoustical Society ('78-), European Acoustics Association ('01-), Acoustical Society of America ('90-); Member of the Faculty Board of Department of Sound Enginnering F. Chopin University of Music ('04-); Member of the Technical Committees KT 105 and KT 121 of the Polish Committee for Standardization (’09-).
Recipient of a team award of the Rector (’16).
[Edu21], [Edu34], [Edu80], [Edu142]; [Pro21], [Pro33]; [MSc24], [MSc27]; [BSc55]; [Pub145], [Pub146], [Pub183], [Pub185], [Pub186], [Pub187], [Pub188], [Pub190], [Pub203].

2.2. Junior academic staff

Grzegorz Bogdan, M. Sc., Assistant (0.5)
room: 35, phone: +48 22 2347796
e-mail: G.Bogdan@ire.pw.edu.pl

Konrad Godziszewski, M.Sc., Assistant (0.5)
room: 35, phone: +48 22 2347796
e-mail: K. Godziszewski@ire.pw.edu.pl

Marek Kowalski, M.Sc., Assistant (0.5)
room: 11, phone: +48 22 2347332
e-mail: M. Kowalski@ire.pw.edu.pl

Jacek Kryszyn, M.Sc., Assistant
room: 59, phone: +48 22 2347577
e-mail: J.Kryszyn@ire.pw.edu.pl

Wojciech Obrębski, M.Sc., Assistant (0.5)
room: 71, phone: +48 22 2346087
e-mail: W.Obrebski@ire.pw.edu.pl

Jarosław Orzeł, M.Sc., Assistant (0.5)
room: 71, phone: +48 22 2346087
e-mail: J.Orzel@ire.pw.edu.pl

Agnieszka Pietrzak, M.Sc., Assistant (from Dec. 2016)
room: 131, phone: +48 22 2347999
e-mail: A.Pietrzak@ire.pw.edu.pl

Andrzej Rychter, Ph.D., Assistant
room: 71, phone: +48 22 2346087
e-mail: A.Rychter@ire.pw.edu.pl

Marcin Ziembicki, M.Sc., Assistant
room: 62, phone: +48 22 2347643
e-mail: M.Ziembicki@ire.pw.edu.pl

2.3. Ph.D. students (the third-level studies)

Ph.D. Student	**(tutor)**
Andrzej Abramowski, M.Sc*.	*(G. Pastuszak)*
Przemysław Buczkowski, M.Sc.	*(W. Skarbek)*
Anna Badawika, M.Sc.	*(J. Modelski)*
Łukasz Błaszczyk, M.Sc.	*(K. Snopek)*
Grzegorz Bogdan, M.Sc.	*(Y. Yashchyshyn)*
Błażej Czupryński, M.Sc.	*(W. Skarbek)*
Vitomir Djaja-Jośko, M.Sc.	*(J. Modelski)*
Monika Drabik, M.Sc.	*(P. Bogorodzki)*
Konrad Godziszewski, M.Sc.*	*(Y. Yashchyshyn)*
Marcin Góralczyk, M.Sc.	*(W. Wojtasiak)*
Wojciech Gradkowski, M.Sc.	*(P. Bogorodzki)*
Daniel Grzywczak, M.Sc.	*(W. Skarbek)*
Grzegorz Gwardys, M.Sc.	*(W. Skarbek)*
Tomasz Karpisz, M.Sc.*	*(W. Gwarek)*
Marcin Kołakowski, M.Sc.	*(J. Modelski)*
Bartosz Kossowski, M.Sc.	*(P. Bogorodzki)*
Marek Kowalski, M.Sc.	*(W. Skarbek)*
Mateusz Krysicki, M.Sc.	*(W. Gwarek)*
Jacek Kryszyn, M.Sc.	(*W. Smolik)*
Dawid Kuchta, M.Sc.	*(W. Wojtasiak)*
Paweł Mazurek, M.Sc.	*(R. Z. Morawski)*
Denys Nyzovets, M.Sc.*	*(Y. Yashchyshyn)*
Jarosław Orzeł, M.Sc.	*(P. Bogorodzki)*
Jakub Pach, M.Sc.	(*P. Bilski)*
Przemysław Piasecki, M.Sc.	*(Y. Yashchyshyn)*
Agnieszka Pietrzak, M.Sc.	*(J. Żera)*
Bartosz Połok, M.Sc.*	(*P. Bilski)*
Rafał Protasiuk, M.Sc.	*(W. Skarbek)*
Adam Raniszewski, M.Sc.*	*(W. Gwarek)*
Agata Rogowska, M.Sc.	*(J. Żera)*
Mateusz Stosio, M.Sc.*	*(W. Smolik)*

Maciej Trochimiuk, M.Sc. *(G. Pastuszak)*
Jakub Wagner, M.Sc. *(R. Z. Morawski)*
Damian Wanta, M.Sc. *(W. Smolik)*
Michał Wieteska, M.Sc. *(P. Bogorodzki)*
Augustyn Wójcik, M.Sc. *(W. Winiecki)*
Przemysław Wróblewski, M.Sc. (*W. Smolik)*
Bartosz Żłobiński, M.Sc. *(J. Żera)*

* without scholarship

2.4. Technical and administrative staff

Anna Czarnecka, M.Sc., Senior R&D Engineer
room: 535, phone: +48 22 2347910
e-mail: A.Czarnecka@ire.pw.edu.pl

Anna Dobrzyńska, Financial Spec. (0.75)
room: 421, phone: +48 22 2347743
e-mail: A.Dobrzynska @ire.pw.edu.pl

Izabela Dudek, Admin. Specialist
room: 557, phone:+48 22 2347627
e-mail: I.Dudek @ire.pw.edu.pl

Zdzisława Fenikowska, M.A., Financial Spec.
room: 421, phone: +48 22 2347743
e-mail: Z.Fenikowska@ire.pw.edu.pl

Aleksandra Jefimowicz, M.A., Financial Spec.
room: 421, phone: +48 22 2346089
e-mail: A.Jefimowicz@ire.pw.edu.pl

Tomasz Krzymień, M.Sc., Senior Devel. Eng. (0.5)
room: 11a, phone: +48 503510402
e-mail: T.Krzymien@ire.pw.edu.pl

Andrzej Laskowski, Worker
room: 419, phone: +48 22 2347987
e-mail: A.Laskowski@ire.pw.edu.pl

Mirosław Lubiejewski, Foreman
room: 532, phone: +48 22 2347633
e-mail: M.Lubiejewski@ire.pw.edu.pl

Grzegorz Makarewicz, Ph.D., Senior R&D Eng. (0,5)
room: 130, phone: +48 22 2347748
e-mail: G.Makarewicz@ire.pw.edu.pl

Marek Marcinkowski, Senior Foreman (0.75)
room: 427, phone: +48 22 2347378
e-mail: M.Marcinkowski@ire.pw.edu.pl

Teresa Miąsek, M.A., Curator of the Library (0,5)
room: 557, phone: +48 22 2347627
e-mail: T.Miasek@ire.pw.edu.pl

Anna Noińska, Secretary
room: 426, phone:+48 22 2345367
e-mail: A.Noinska@ire.pw.edu.pl

Janina Nowak, Accountant
room: 420, phone: +48 22 2347645
e-mail: J.Nowak@ire.pw.edu.pl

Denys Nyzovets, M. Sc., Devel. Eng.*
room: 35, phone: +48 22 2347796
e-mail: D.Nyzovets@ire.pw.edu.pl

Andrzej Owczarek, M.Sc., Senior Devel. Eng. (0.25)
room: 552A, phone: +48 22 2347233
e-mail: A.Owczarek@ire.pw.edu.pl

Marcin Piasecki, Ph.D., R&D Eng. (0.5)**
room: 546, phone: +48 22 2345829
e-mail: M.Piasecki@ire.pw.edu.pl

Monika Różycka, M.A., Secretary
room: 424, phone:+48 22 2347829, +48 22 8255248
e-mail: M.Rozycka@ire.pw.edu.pl

Błażej Sawionek, Ph.D., Senior R&D Eng. (0.5, to Aug. 2016)
room: 68, phone: +48 22 2347917
e-mail: B.Sawionek@ire.pw.edu.pl

Andrzej Skrzypkowski, Technician (0.5)
room: 419, phone: +48 22 2345018
e-mail: A.Skrzypkowski@ire.pw.edu.pl

Anna Smenda, Secretary
room: 422, phone: +48 22 2347742,
+48 22 8253929
fax: +48 22 8253769
e-mail: A.Smenda@ire.pw.edu.pl

Anna Tratkiewicz, Secretary
room: 422, phone: +48 22 2347233,
+48 22 8253929
e-mail: A.Tratkiewicz@ire.pw.edu.pl

Andrzej Wasilewski, Worker
room: 73, phone: +48 22 2347919
e-mail: A.Wasilewski@ire.pw.edu.pl

Joanna Witkowska, Specialist
room: 66, phone: +48 22 2347955, +48 22 8251363
e-mail: J.Witkowska@ire.pw.edu.pl

Stanisław Żmudzin, M.Sc., Senior R&D Eng. (0.25, till Sept. 2016)
room: 27, phone: +48 22 2347635
e-mail: S.Zmudzin@ire.pw.edu.pl

temporary research staff of the projects:

*CELTA, **Methods of Protection and Defense Against the HPM Impulses

3. TEACHING ACTIVITIES

(the summer semester of the academic year 2015/2016 and the winter semester of the academic year 2016/2017)

3.1. Regular studies – Main Fields of Study:

1. Telecommunications
Specialization: Radiocommunications and Multimedia Technology

Head

Jacek Cichocki, Ph.D., Reader
room: 27, phone: +48 22 2347635
e-mail: J.Cichocki@ire.pw.edu.pl

2. Electronics
Specialization: Electronics and Information Technology in Medicine

Head

Krzysztof Zaremba, Prof. D.Sc., Tenured Professor
room: 72, phone: +48 22 2347955, +48 22 2347497
e-mail: K.Zaremba@ire.pw.edu.pl

3.1.1. Basic courses

[Edu1] *Acquisition and Data Processing Using LabVIEW* (Akwizycja i przetwarzanie danych z wykorzystaniem LabVIEW – LABV); 30 h/sem.; W. Winiecki, P. Bilski, P. Bobiński.

[Edu2] *Analysis of Measurement Data in Medicine* (Analiza danych pomiarowych w medycynie – ADP); 45 h/sem.; B. Konarzewski.

[Edu3] *Antennae and Radiowave Propagation* (Anteny i propagacja fal – ANT); 45 h/sem.; Y. Yashchyshyn.

[Edu4] *Basic Radio-frequency Circuits* (Podstawowe układy radioelektroniczne – PURAD); 45 h/sem.; J. Modzelewski, W. Kazubski.

[Edu5] *Basics of Radiolocation and Radionavigation* (Podstawy radiolokacji i radionawigacji – PRIR); 45 h/sem.; S. Rosłoniec.

[Edu6] *Basics of Sound Techniques* (Podstawy techniki dźwiękowej – PTD); 60 h/sem.; P. Bobiński.

[Edu7] *Basics of Information Techniques* (Podstawy technik informacyjnych – PTIB); 30 h/sem.; R. Kurjata.

[Edu8] *Basics of Medical Imaging* (Podstawy obrazowania medycznego – POMED); 45 h/sem.; P. Brzeski.

[Edu9] *Basics of Medical Imaging Techniques* (Podstawy technik obrazowania w medycynie – PTOM); 60 h/sem.; P. Brzeski.

[Edu10] *Basics of Microprocessor Technique* (Podstawy techniki mikroprocesorowej – TMIK); 60 h/sem.; K. Derzakowski B. Konarzewski.

[Edu11] *Basics of Programming* (Podstawy programowania – PRM); 60 h/sem.; A. Podgórski.

[Edu12] *Basics of Radiocommunications* (Podstawy radiokomunikacji – PR); 45 h/sem.; J. Cichocki, K. Kurek.

[Edu13] *Basics of Image Techniques* (Podstawy techniki obrazowej – PTO); 45 h/sem.; G. Galiński.

[Edu14] *Biomedical Accelerators* (Akceleratory biomedyczne – ABM); 30 h/sem.; S. Wronka.

[Edu15] *Computer Graphics* (Grafika komputerowa – GRK); 30 h/sem.; B. Sawionek.

[Edu16] *Construction of High Quality Audio Equipment* (Konstrukcja urządzeń audio wysokiej jakości – KUA); 30 h/sem.; G. Makarewicz.

[Edu17] *Detection of Nuclear and Biomedical Signals* (Detekcja sygnałów biomedycznych i jądrowych – DSBJ); 60 h/sem.; J. Marzec.

[Edu18] *Digital Cellular Systems* (Cyfrowe systemy komórkowe – CSK); 45 h/sem.; J. Kołakowski.

[Edu19] *Digital Circuits* – EDC1; 60 h/sem.; P. Miazga (English-medium studies).

[Edu20] *Digital Communications* – EDICO; 60 h/sem.; P. Bilski (English-medium studies).

[Edu21] *Diploma Seminar for Undergraduate Students* (Seminarium dyplomowe inżynierskie – SDI); 30 h/sem.; P. Brzeski, W. Gwarek, J. Marzec, Y. Yashchyshyn, J. Żera.

[Edu22] *Digital Systems* (Układy cyfrowe – UCYF); 60 h/sem.; K. Mroczek, T. Olszewski, D. Rosołowski.

[Edu23] *Dc/dc Power Converters Supply* (Zasilanie układów elektronicznych - ZUE); 45 h/sem.; M. Mikołajewski.

[Edu24] *Event-Driven Programming* (Programowanie zdarzeniowe – PROZE); 45 h/sem.; K. Ignasiak.

[Edu25] *Evolutionary Algorithms* (Algorytmy ewolucyjne – AE); 45 h/sem.; P. Miazga.

[Edu26] *Ethical Aspects of Research and Engineering* – EEARE; 30 h/sem; R. Z. Morawski (English-medium studies).

[Edu27] *Fields and Waves* (Pola i fale – POFA); 60 h/sem.; W. Gwarek, B. Salski.

[Edu28] *Influence of Electromagnetic Waves on Living Organisms* (Oddziaływanie fal elektromagnetycznych na organizmy żywe – OFE); 30 h/sem.; K. Derzakowski.

[Edu29] *Introduction to Numerical Methods* (Wstęp do metod numerycznych – WNUM); 45 h/sem.; R. Z. Morawski, A. Miękina, A. Podgórski.

[Edu30] *Measurement Systems* (Systemy pomiarowe – SPOM); 60 h/sem.; W. Winiecki.

[Edu31] *Medical Electronic Instrumentation* (Elektroniczna aparatura medyczna – EAME); 60 h/sem.; M. Dziewiecki, R. Szabatin, T. Jamrógiewicz, E. Piątkowska - Janko.

[Edu32] *Microwave Technique (*Technika mikrofalowa – TMO); 45 h/sem.; W. Wojtasiak.

[Edu33] *Multi-service and Multimedia Networks* – EMSMN; 60 h/sem.; T. Keller (English--medium studies).

[Edu34] *Musical Acoustics* (Akustyka muzyczna – AM); 30 h/sem.; J. Żera.

[Edu35] *Noise Control* (Ochrona przed hałasem – OPH); 30 h/sem.; E. Kotarbińska (for Faculty of Environmental Engineering).

[Edu36] *Nuclear Medicine Techniques* (Techniki medycyny nuklearnej – TMENU); 30 h/ sem.; R. Szabatin.

[Edu37] *Numerical Methods* (Metody numeryczne – MNUB); 45 h/sem.; R. Z. Morawski, A. Miękina, A. Podgórski.

[Edu38] *Numerical Methods* – ENUME; 60 h/sem.; R. Z. Morawski, A. Miękina, A. Podgórski (English-medium studies).

[Edu39] *Object-oriented Programming M* (Programowanie obiektowe M – PROE); 60 h/sem.; J. Naruniec.

[Edu40] *Object-oriented Programming of Multimedia Applications in Java (*Java – obiektowe programowanie aplikacji multimedialnych – OPA); 45 h/sem.; K. Ignasiak.

[Edu41] *Operating Systems* (Systemy operacyjne – SOE); 45 h/sem.; M. Sypniewski.

[Edu42] *Orientation* (Orientacja – ORM); 15 h/sem.; J. Cichocki.

[Edu43] *Physics 2* – EPHY2; 60 h/sem.; B. Salski (English-medium studies).

[Edu44] *Programming Languages* (Języki programowania - JP); 75 h/sem.; W. Smolik.

[Edu45] *Radiation Detection* (Detekcja promieniowania jonizującego – DEPJO); 30 h/sem.; J. Marzec.

[Edu46] *Radiocommunication Systems* (Systemy radiokomunikacyjne – SRKO); 45 h/sem.; T. Kosiło, K. Godziszewski.

[Edu47] *Radioelectronics Measurements (*Miernictwo radioelektroniczne – MR); 45 h/sem.; J. Cichocki.

[Edu48] *Radio Networks and Systems* (Systemy i sieci radiowe – SISR); 45 h/sem.; T. Keller, K. Godziszewski.

[Edu49] *Radiological Apparatus in Medical Diagnostics* (Aparatura radiologiczna w diagnostyce medycznej – ARDM); 30 h/sem.; G. Domański.

[Edu50] *Radiology and Nucleonics* (Radiologia z nukleoniką – RN); 45 h/sem.; K. Zaremba.

[Edu51] *Satellite Communications* (Łączność satelitarna – LS); 45 h/sem.; K. Kurek.

[Edu52] *Selected Problems of Modern Television* (Wybrane zagadnienia współczesnej telewizji – WZWT); 30 h/sem.; M. Rusin.

[Edu53] *Signal Processors in Audio Techniques* (Procesory sygnałowe w technice audio – PSTA); 45 h/sem., P. Bobiński.

[Edu54] *Signals and Systems* (Sygnały i systemy – SYGSY); 60 h/sem.; K. Snopek.

[Edu55] *Signals, Modulations and Systems (*Sygnały, modulacje i systemy – SYMSE); 45 h/sem.; K. Snopek.

[Edu56] *Simulations of Radioelectronics Circuits* (Symulacja układów radioelektronicznych – SUREL); 45 h/sem.; D. Gryglewski.

[Edu57] *Software for Medical Systems (*Oprogramowanie systemów medycznych – OSM); 45 h/sem.; R. Kurjata, T. Jamrógiewicz.

[Edu58] *Sound Recording Technique* (Dźwiękowa technika studyjna – DTS); 45 h/sem.; M. Lewandowski.

[Edu59] *Television Systems* (Systemy telewizyjne – SYTE); 45 h/sem.; A. Buchowicz, M. Rusin.

[Edu60] *Ultrasonography Instrumentation* (Aparatura ultrasonograficzna – AUS); 30 h/sem.; R. Jóźwiak.

[Edu61] *UMTS System (System UMTS – UMTS);* 45 h/sem.; J. Kołakowski.

[Edu62] *Visualization and Modeling in Multimedia* (wizualizacja i modelowanie w multimediach – WIM); 45 h/sem.; W. Skarbek.

3.1.2 Advanced courses

[Edu63] *Adaptive Image Recognition* – EADIR; 60 h/sem.; W. Skarbek.

[Edu64] *Antennae Theory and Design* (Teoria i projektowanie anten – TPA); 60 h/sem.; Y. Yashchyshyn.

[Edu65] *Audio Equipment Investigation* (Badania urządzeń audio – BUA); 45 h/sem.; Z. Kulka.

[Edu66] *Computed Tomography* (Tomografia komputerowa – TOM); 60 h/sem.; W. Smolik.

[Edu67] *Computer - Aided Medical Image Diagnostics* (Komputerowe wspomaganie obrazowej diagnostyki medycznej – KWOD); 45 h/sem.; A. Przelaskowski.

[Edu68] *Computional Electromagnetics for Telecommunications* – ECOET; 60 h/sem.; W. Gwarek, A. Więckowski (English-edium studies).

[Edu69] *Contemporary Heuristic Techniques* (Współczesne techniki heurystyczne – WMH); 60 h/sem.; P. Bilski.

[Edu70] *Data Compression* (Kompresja danych – KODA); 45 h/sem.; A. Buchowicz, G. Galiński.

[Edu71] *Design of Radiocommunication Systems* (Projektowanie układów radiokomunikacyjnych – PSRD); 60 h/sem.; T. Kosiło.

[Edu72] *Digital Audio Signal Processing* (Cyfrowe przetwarzanie sygnałów fonicznych – CPSF); 45 h/sem.; Z. Kulka.

[Edu73] *Digital Image Processing* (Cyfrowe przetwarzanie obrazów – CPOO); 30 h/sem.; P. Brzeski.

[Edu74] *Diploma Seminar for Graduate Students 1* (Seminarium dyplomowe magisterskie 1 – SDM1); 30 h/sem.; P. Brzeski, W. Gwarek, Z. Kulka, J. Marzec, J. Modelski., K. Zaremba

[Edu75] *Diploma Seminar for Graduate Students 2* (Seminarium dyplomowe magisterskie 2 – SDM2); 30 h/sem.; P. Brzeski, W. Gwarek, Z. Kulka, J. Marzec, J. Modelski, K. Zaremba.

[Edu76] *Distributed Measurement and Control Systems* (Rozproszone systemy pomiarowo-kontrolne – RSPK); 45 h/sem.; W. Winiecki, R. Łukaszewski.

[Edu77] *Electromagnetic Compatibility* (Kompatybilność elektromagnetyczna – KE); 30 h/sem.; P. Kopyt.

[Edu78] *Evolutionary Algorithms* – EEVAL; 60 h/sem.; P. Miazga (English-medium studies).

[Edu79] *Graphs and Networks* (Grafy i sieci – GIS); 60 h/sem.; S. Kozłowski.

[Edu80] *Hearing and Sound Perception* (Słyszenie i percepcja dźwięku – SPD); 45 h/sem.; J. Żera.

[Edu81] *Image and Audio Semantic Analysis* (Analiza semantyczna dźwięku i obrazu – ASOD); 45 h/sem.; J. Naruniec.

[Edu82] *Informatics Systems in Medicine* (Systemy informatyczne w medycynie – SIM); 45 h/sem.; W. Smolik.

[Edu83] *Large-scale Measurement Methods in Molecular Biology* (Wielkoskalowe metody pomiarowe w biologii molekularnej – MPB); 45 h/sem; T. Rubel.

[Edu84] *Magnetic Resonance Imaging* (Tomografia rezonansu magnetycznego – TRM); 45 h/sem.; P. Bogorodzki.

[Edu85] *Mathematics in Multimedia* (Matematyka w multimediach – MATMU); 60 h/sem.; W. Skarbek.

[Edu86] *Methodological and Ethical Aspects of Research* – EMAR); 45 h/sem.; R. Z. Morawski.

[Edu87] *Neural Networks in Biomedical Applications* (Sieci neuronowe w zastosowaniach biomedycznych – SNB); 45 h/sem., K. Zaremba.

[Edu88] *Noise and Electromagnetic Interference in Electronic Devices* (Szumy i zakłócenia w aparaturze elektronicznej – SZAE); 45 h/sem., J. Marzec.

[Edu89] *Nuclear Medicine Techniques* (Techniki medycyny nuklearnej – TMN); 60 h/sem.; R. Szabatin.

[Edu90] *Radio Localization and Identification Systems* (Radiowe systemy lokalizacji i identyfikacji – RADS); 45 h/sem.; P. Bajurko.

[Edu91] *Telemedical Systems* (Systemy telemedyczne - TELM); 45 h/sem., R. Kurjata.

[Edu92] *Ultrawideband Technologies* (Techniki ultraszerokopasmowe - TUSP); 45 h/sem., J. Kołakowski.

3.2. Special courses

3.2.1 Engineer Degree Evening Studies on Radiocommunications and Multimedia Technology

[Edu93] *Antennae* (Anteny – ANM); 30 h/sem.; semester 4; S. Rosłoniec.

[Edu94] *Basics of Computer Techniques* (Podstawy techniki komputerowej – PKOM); 45 h/sem.; semester 1; R. Kurjata.

[Edu95] *Basics of High-Frequency Techniques* (Podstawy techniki w.cz. – PTWM); 60 h/sem.; semester 3; D. Gryglewski.

[Edu96] *Basics of Logical Circuits and Microprocessor Technique* (Układy logiczne i podstawy techniki mikroprocesorowej – PULM); 60 h/sem.; semester 4; B. Konarzewski.

[Edu97] *Basics of Metrology* (Podstawy metrologii – PMEM); 45 h/sem.; semester 1; W. Winiecki.

[Edu98] *Basics of Satellite Communications* (Podstawy łączności satelitarnej – SATM); 15 h/sem.; semester 4; K. Kurek.

[Edu99] *Broadcasting systems* (Systemy radiodyfuzyjne – SRDM); 60 h/sem.; semester 6; A. Buchowicz, H. Chaciński.

[Edu100] *Circuits and Signals* (Obwody i sygnały – OSRM); 45 h/sem.; semester 2; M. Dziewiecki.

[Edu101] *Computer Control and Data Processing* (Komputerowe sterowanie i przetwarzanie danych – KSTM); 45 h/sem.; semester 4, W. Winiecki.

[Edu102] *Digital Cellular Systems* (Cyfrowe systemy komórkowe – CSKM); 36 h/sem.; semester 7; J. Cichocki.

[Edu103] *Digital Signals Transmission* (Cyfrowa transmisja sygnałów – CTSM); 45 h/sem.; semester 5; T. Kosiło.

[Edu104] *Diploma Seminar 1* (Seminarium dyplomowe – SDM); 15 h/sem.; semester 6; J. Cichocki.

[Edu105] *Diploma Seminar 2* Seminarium dyplomowe – SD2M); 30 h/sem.; semester 7; J. Cichocki.

[Edu106] *Electronic Circuits* (Układy elektroniczne – UEM); 45 h/sem.; semester 3; D. Gryglewski.

[Edu107] *Ergonomics and Safety* (Ergonomia i bezpieczeństwo pracy – EBPZ); 30 h/sem.; semester 8; L. Kryst.

[Edu108] *Fields and Waves* (Pola i fale – PFM); 60 h/sem.; semester 2; D. Rosołowski.

[Edu109] *Information and Knowledge Society* (Społeczeństwo informacji i wiedzy – SWM); 15 h/sem.; semester 8; P. Stacewicz.

[Edu110] *Internet Techniques* (Techniki Internetowe – TINM), 30 h/sem.; semester 7; K. Ignasiak.

[Edu111] *Introduction to Programming* (Wstęp do programowania – WPRM); 15 h/sem.; semester 2; R. Kurjata.

[Edu112] *Materials and Elements* (Materiały i elementy – MEM); 15 h/sem.; semester 3; K. Radecki.

[Edu113] *Multimedia Applications* (Aplikacje multimedialne – AMRM); 30 h/sem.; semester 5; T. Rubel.

[Edu114] *Multimedia Computer Systems* (Multimedialne systemy komputerowe – MSKM); 30 h/sem.; semester 4; T. Jamrógiewicz.

[Edu115] *Multimedia Techniques* (Techniki Multimedialne – TMM); 30h/sem.; semester 6; G. Galiński.

[Edu116] *Numerical and Statistical Techniques* (Techniki obliczeniowe i symulacyjne – TOSM); 30 h/sem.; semester 4; A. Miękina.

[Edu117] *Programmable Digital Devices* (Programowalne układy cyfrowe – PUCM); 30 h/sem.; semester 5; M. Ziembicki.

[Edu118] *Programming* (Programowanie – PMRM); 30 h/sem.; semester 3; R. Kurjata.

[Edu119] *Radiocommunication Systems 1* (Systemy radiokomunikacyjne 1 – SRKM); 60 h/sem.; semester 6; T. Kosiło.

[Edu120] *Radiocommunication Systems 2* (Systemy radiokomunikacyjne 2 – SRK2M); 60 h/sem.; semester 7; T. Kosiło.

[Edu121] *Radioelectronics Measurements* (Miernictwo radioelektroniczne – MRM); 45 h/sem.; semester 5; J. Cichocki.

[Edu122] *Rules of Industrial Property* (Prawa własności przemysłowej – PWPR); 15 h/sem.; semester 7; M. Bury.

[Edu123] *Signal Processors* (Procesory sygnałowe – SKMM); 30 h/sem.; semester 6, A. Podgórski.

[Edu124] *Signals and Modulations* (Sygnały i modulacje – SMRM); 60 h/sem.; semester 3; K. Snopek, K. Radecki.

[Edu125] *Sound Techniques* (Techniki dźwiękowe – TDRM); 30 h/sem.; semester 7; P. Bobiński.

[Edu126] *Technique of Emission and Receiving* (Technika emisji i odbioru – TEM); 45 h/sem.; semester 5; J. Modzelewski, W. Kazubski.

3.2.2. Environmental Noise Course

The Environmental Noise Course represents a series of courses; 135h.

[Edu127] *Basics of Acoustics* (Podstawy akustyki); 25 h; M. Tajchert, A. Leszczyński.

[Edu128] *Basics of Statistics* (Podstawy statystyki); 10 h; M. Kirpluk.

[Edu129] *Environment Noise Prediction* (Prognozowanie emisji hałasu w środowisku); 10 h; M. Kirpluk.

[Edu130] *Noise in the Workplace* (Hałas w środowisku pracy); 6 h; E. Kotarbińska.

[Edu131] *Legal Environment Noise Regulations* (Regulacje prawne w zakresie ochrony środowiska przed hałasem); 4 h; M. Wojciechowska.

[Edu132] *Noise Measuring and Monitoring Methods* (Metody pomiaru i monitorowania hałasu); 16h; M. Kirpluk, J. Maciejczyk, P. Tomczyk.

[Edu133] *Noise Control* (Zabezpieczenia akustyczne); 10 h; J. Sikora, G. Makarewicz.

[Edu134] *Human Health Effects of Noise* (Wpływ hałasu na organizm ludzki); 4 h; Z. Koszarny.

[Edu135] *Noise Mapping* (Mapy akustyczne); 6 h; J. Grabowski.

[Edu136] *Research Laboratories Accreditation* (Akredytacja laboratoriów badawczych); 6 h; M. Szeląg.

[Edu137] *Selected Problems in Building Acoustics* (Wybrane zagadnienia z akustyki budowlanej); 16 h; M. Niemas.

[Edu138] *Uncertainty of Noise Measurements* (Niepewność pomiarów); 8h; M. Kirpluk.

[Edu139] *Workshop - Noise Measurements* (Warsztaty - pomiary hałasu); 10 h; M. Kirpluk, J. Maciejczyk, P. Tomczyk.

3.2.3. B.Sc. Level e-learning Special Courses

Warsaw University of Technology Distant Learning Center – OKNO (Ośrodek Kształcenia na Odległość Politechniki Warszawskiej – OKNO)

[Edu140] *Basics of Sound Technique* (Podstawy techniki dźwiękowej); 30 h/sem.; Z. Kulka.

[Edu141] *Systems and Devices of Sound Technique* (Urządzenia i systemy techniki dźwiękowej); 30 h/sem.; Z. Kulka.

3.3. Educational projects

[Edu142] **International Master's Degree in multiMEDIA – Technology, Design, Management** (Studia II stopnia w języku angielskim: multimedia – technologie, projektowanie, zarządzanie)

Józef Modelski, W. Skarbek, J. Żera, P. Bobiński, A. Buchowicz, G. Galiński, K. Ignasiak, T. Kosiło;
Apr. 11, 2014 – Dec. 31, 2016
Foundation for the Development of the Education System, Norway Grants

The main objective of the project is to improve the quality of education and tailoring the teaching offer of the Warsaw University of Technology to the needs of labour market. The project is divided into 56 tasks and supports more than 21,000 people. Most of the action is addressed to students and PhD students, while a small part supports academic staff and people outside the academic staff.

3.4. International co-operation

Within the Advanced Technology Higher Education Network / Socrates (ATHENS), from March 14 to March 18, the course *"Ethical Aspects of Research and Engineering"* was given by **Roman Z. Morawski**, *"Sound Hearing and Acoustical Measurements"* was given by **Jan Żera** from November 14 to November 18 to a group of 57 students. The students who attended this course were from the following EU institutions of higher education:

- Czech Technical University in Prague 1 person);
- École des Mines de Paris, Paris, France (2 persons);
- École Nationale Supérieure d'Arts et Métiers, Paris, France (2 person);
- École Nationale Supérieure des Télécommunications de Paris, Paris, France (8 persons);
- École Supérieure de Physique et de Chimie Industrielle, Paris, France (5 persons);
- Institut d'Optique Graduate School, Paris, France (1 person);
- Istanbul Technical University (1 person);
- Katholieke Universiteit Leuven, Leuven, Belgium (19 persons);
- Norvegian University of Science and Technology 1 person);
- Politecnico di Milano, Milano, Italy (4 persons);
- Technische Universiteit Delft, Delft, The Netherlands (4 person);
- Technische Universität München, München, Germany (3 persons);
- Telecom ParisTech (3 persons);
- Universidad Politécnica de Madrid, Madrid, Spain (3 person).

The courses included 20 hours of lectures and 10 hours of class tutorials.

4. RESEARCH ACTIVITIES

4.1. International projects

4.1.1. European grants

[Pro1] **Super-Kamiokande Plus**
Krzysztof Zaremba
M. Dziewiecki, M. Ziembicki, A. Rychter;
Nov. 11, 2014 – Nov. 11, 2018
Horizon 2020, EU Framework Programme for Research and Innovation

The project is realized in the frame of MSCA-RISE--2014: Marie Skłodowska-Curie Research and Innovation Staff Exchange, as a part of collaboration between the Warsaw University of Technology, Institute of Radioelectronics and Multimedia Technology, the A. Soltan Institute of Nuclear Studies and Universidad Autonoma de Madrid. This project is a part of ongoing global efforts to understand the most fundamental elements of matter and their interactions. We aim to investigate neutrino interactions using the existing experimental facility in Japan, the Super-Kamiokande (SK) detector located in the Kamioka Observatory (Gifu Prefecture) and owned by the Partner of this project: the Institute for Cosmic Ray Research of the University of Tokyo. The collaborative work with the leaders of the field, the Japanese Groups and Research Facilities, should assure the researches the gain of an invaluable experience from these studies, covering neutrino physics, cosmology, astrophysics, technical design, construction and operation of water Cherenkov detectors, data analysis techniques, hardware and software development for the new generation detectors.

[Pro2] **CELTA – Convergence of Electronics and Photonics Technologies for Enabling Terahertz Applications** (Konwergencja elektroniki i technik fotonicznych na rzecz rozwoju zastosowań techniki).
Yevhen Yashchyshyn, D. Nyzovets;
Mar. 01, 2016 – Feb. 29, 2020

CELTA is the acronym for Convergence of Electronics and Photonics Technologies for Enabling Terahertz Applications. CELTA aims to produce the next generation of researchers who will enable Europe to take a leading role in the multidisciplinary area of utilising Terahertz technology for applications involving components and complete systems for sensing, instrumentation, imaging, spectroscopy, and communications. All these technologies are keys to tackling challenges and creating solutions in a large number of focus areas relevant for the societal challenges identified in the Horizon 2020 programme. To achieve this objective, CELTA is comprised of 11 leading research institutions and has assembled a comprehensive research training programme for all the 15 early-stage researchers (ESRs). CELTA integrates multidisciplinary scientific expertise, complementary skills, and experience working in academia and industry to empower ESRs to work in interdisciplinary teams, integrate their activities, share expertise, and promote a vision of a converged co-design and common engineering language between electronics and photonics for Terahertz technologies. CELTA will introduce the strategy of converged electronics and photonics co-design in its research programme and makes a special effort on establishing a common engineering language in its training programme across the electronics, photonics and applications disciplines. We believe this common engineering language and converged co-design is mandatory to make the next logical step towards efficient and innovative solutions that can reach the market. The detailed compendium of lectures on state-of-the-art technology, soft skills and entrepreneurship is accompanied by a research programme that focuses on THz key technologies. CELTA ESRs will develop three demonstrators: beam steering technology for communication applications, a photonic vector analyser for spectroscopy and materials characterisation, and a THz imager for sensing applications.

[Pro3] **High-Precision Technique of Millimeter and sub-THz Band Characterization of Materials for Microelectronics** (Wysokoprecyzyjne techniki charakteryzacji materiałów w zakresie fal milimetrowych oraz subterahercowych do zastosowań mikroelektronicznych).
Jerzy Krupka (IMiO) **Paweł Kopyt** (IRiTM): heads of research teams;
Nov. 01, 2016 – Oct. 31, 2019
TEAM-TECH, EU Framework Programme "Intelligent Development 2014-2020"

The main objective of this project will be to develop novel sensors and sensing methodologies useful to non-destructive contactless electric and magnetic characterization of materials at millimeter and sub-THz spectra. The implementation of this goal will be two-pronged. On one hand, the said resonant structures will be exploited to benefit from their inherent narrow-band properties, which are particularly useful at measuring low-loss materials. On the other hand, the research will also concern broadband measurement techniques based on multimode resonant structures. The auxiliary goal is adopting the technological approaches typical for the microelectronics industry and apply them for precise fabrication of novel resosnat cavities operating in the millimeter and the sub-THz bands. Another such goal is development of a new low-loss yet high dielectric constant materil for dielectric posts inserted into sensing cavities.

4.2 Projects granted by the Ministry of Science and Higher Education (National Centre for Research and Development, and National Science Center)

4.2.1. International grants

[Pro4] **The COMPASS Experiment – the Research on the Spin Structure of Nucleon** (Eksperyment COMPASS – badanie spinowej struktury nukleonu).
Krzysztof Zaremba, J. Marzec, M. Dziewiecki, G. Domański, B. Konarzewski, R. Kurjata, M. Ziembicki, A. Rychter;
COMPASS, International project realized in collaboration with the Andrzej Soltan Institute for Nuclear Studies and Faculty of Physics, Warsaw University;
Dec. 12, 2011 – Nov. 30, 2016
Funded by the National Science Center

The project was a part of the long-term collaboration between the Institute of Radioelectronics and Multimedia Technology, and the international high-energy physics experiment COMPASS (Na58) at CERN

(Geneva). Within the framework of a new program the team from the Institute of Radioelectronics and Multimedia Technology was responsible (together with the teams from the A. Soltan Institute of Nuclear Studies, and Warsaw University) for the design of new methods of the experimental data analysis, including applications of the "soft computing" methods (neural networks, genetic algorithms etc.). The Institute was also involved in preparations of the hardware upgrade of the COMPASS experiment for the new physical program.

[Pro5] **Experiment COMPASS - Study of the Three-Dimensional and Spin Structure of the Nucleon** (Eksperyment COMPASS – badanie trójwymiarowej i spinowej struktury nukleonu).
Krzysztof Zaremba, J. Marzec, M. Dziewiecki, G. Domański, B. Konarzewski, R. Kurjata, M. Ziembicki, A. Rychter;
HARMONIA, International project realized in collaboration with the Andrzej Soltan Institute for Nuclear Studies and Faculty of Physics, Warsaw University;
May 23, 2016 – May 22, 2018
Funded by the National Science Center

The objective of the project are studies of the nucleon three-dimensional and spin structure in terms of its constituents: quarks and gluons. The descripton of the three-dimensional structure is provided either by the TMD formalism (Transverse Momentum Dependent distributions) or alternatively by the GDP formalism (General Parton Distributions). Both approaches are complementary and also describe correlations between parton internal degrees of freedom and their correlations with the nucleaon spin. In particular, they allow us to investigate the role of total and orbital angular momenta of partons (quarks and gluons) in explaining the nucleon spin ½ . The problem is know since about 30 years as the ‘nucleon spin puzzle’ and still remains not completely solved. While the total contribution of quarks to the nucleaon spin is by now well established to be about 30%, the present knowledge about the role of the gluon spin and of the orbital angular momenta of quarks and gluons is still limited.

[Pro6] **The T2K Neutrino Second Generation Experiment** (T2K – eksperyment neutrinowy drugiej generacji).
Krzysztof Zaremba, J. Marzec, M. Dziewiecki, G. Domański, B. Konarzewski, R. Kurjata, M. Ziembicki, A. Rychter, P. Płoński;
HARMONIA, International project realized in collaboration with the Faculty of Physics, Warsaw University, the Andrzej Soltan Institute for Nuclear Studies, the Henryk Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences, Faculty of Physics and Astronomy, Wroclaw University, Silesian University;
Oct. 10, 2012 – Jun. 30, 2017
Funded by the National Science Center

The main aim of this project is the software development and responsibility for modules associated with SMRD, NuWro software for the simulation of neutrino interactions, quality control and data analysis tools, dedicated software, investigations of ND 280 detector.

[Pro7] **Microwave S Band HEMT Transistor based on AlGaN/GaN Heterostructures Grown on Bulk Monocrystalline GaN Substrates** (Tranzystory mikrofalowe HEMT AlGaN/Ga na monokrystalicznych podłożach GaN).
Wojciech Wojtasiak, D. Rosołowski, D. Gryglewski, W. Gwarek;
Dec. 07, 2012 – Apr. 30, 2016
Funded by the National Centre for Research and Development

This project was carried out at the Institute of Electron Technology, Ammono S.A., Institute of High Pressure Physics Polish Academy of Sciences, Top-Gan Ltd., Institute of Physics Polish Academy of Sciences. The objective of this project was to research and develop a new type of microwave S band HEMT transistor based on novel AlGaN/GaN heterostructures grown on bulk monocrystalline semiinsulating GaN substrates. The substrates were fabricated by ammono--thermal method and their size scaled for 1” to 1.5”. Two techniques - MOVPE and MBE were used for the epitaxial growth of HEMT structures with high concentration and high mobility electron 2D gas, and improved structural quality. The fundamental approach behind the workplan was based upon the interaction between four key technical areas of expertise: (i) HEMTs modelling and design, (ii) material growth and characterisation, (iii) devices fabrication and (iv) packaging and chip assessment. A number of specific processing steps were optimised including the definition of the active device area, RIE/ICP etching for ohmic contacts and gate recessing, through-wafer via holes fabrication.

[Pro8] **Properties of Neutrinos and Decay of Protons in Large Liquid Argon T600 Detector for ICARUS Experiment** (Własności neutrin i rozpady protonu – badania przy użyciu wielkiego ciekło-argonowego detektora T600 eksperymentu ICARUS).
Krzysztof Zaremba, P. Płoński;
HARMONIA, International project realized in collaboration with the Andrzej Soltan Institute for Nuclear Studies, the Henryk Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences, Silesian University;
Dec. 21, 2012 – Dec. 20, 2016
Funded by the National Science Center

The aim of project was the analyze of neutrinos properties, and decay of protons in large liquid argon detector. The Nuclear and Medical Electronics Division group contributed in the project. The main area of work was concentrated in developing automatic system for events recognition. The group proposed an algorithm for designating the number, direction and particle's type of tracks which start from initial vertex.

[Pro9] **Care Support for Elderly and Disabled People by Radar Sensor Technology** (Zastosowanie czujników radarowych do wspomagania opieki nad osobami starszymi i niepełnosprawnymi).
Wiesław Winiecki, R. Z. Morawski, Y. Yashchyshyn, K. Derzakowski, R. Łukaszewski, A. Miękina, P. Bajurko, K. Godziszewski;
RADCARE, Polish-Norwegian international project realized in collaboration with

Bergen University College, Norway;
May 1, 2013 – Apr. 30, 2016
Funded by the National Centre for Research and Development

The primary objective of this project was to examine new applications of impulse - radar technology in preventive care and diagnostics of various health conditions. The investigated technique for supervision of elderly and disabled persons was an alternative to the techniques based on visual cameras and wearable devices. It enables non-invasive measurements of both human body movements and selected bodily functions. Its applicability and usefulness in the nursing homes was examined, and corresponding prototype solutions were developed.

[Pro10] **Self-Navigated Integrin Receptors Seeking "Thermally-Smart" Multifunctional Few-Layer Grahene-Encapsulated Magnetic Nanoparticles for Molecular MRI--Guided Anticancer Treatments in "Real Time" Personalized Nanomedicine** (Samonaprowadzające na receptory integrynowe "termicznie-rektywne" wielofunkcyjne nanocząstki magnetyczne enkapsułowane w kilku warstwach grafenu w molekularnym obrazowaniu MR przeciwnowotworowej terapii opartej na persona lizowanej nanomedycynie "czasu rzeczywistego").
Piotr Bogorodzki, E. Piątkowska-Janko, B. Kossowski, J. Orzeł;
Aug. 03, 2015 – Feb. 28, 2018
GEMNS, FP7 ERA-NET EuroNanoMed II

The GEMNS project is realized in collaboration between the Warsaw University of Technology, Medical University of Warsaw, University of Warsaw, University of Bergen, Babes-Bolyai University of Cluj, NILU Norwegian Institute for Air Research, Sciencepharma Ltd. The project is designed to develop novel, thermally "smart", multifunctional, multi-layered graphene-encapsulated magnetic nanoparticles (GEMNS) for molecular MR imaging (mMRI) and anticancer treatments. The theranostic GEMNS will be bioengineered with self-assembled polymeric nano-gels and decorated with antibodies that recognize; certain integrin receptors on lung cancer tissues and identify new cancer vessels. A chosen enzyme will be absorbed onto the GEMNS and releases in a controllable and fully predictable manner in order to promote anticancer activity. The release of the enzyme triggers "on-off" hypoxia states at the molecular level in lung cancer cells and tissues. After several courses of such enzymatic-based molecular pre-sensing, mMRI-guided targeted X-ray radiotherapy will be applied to target lung cancer in preclinical animal models. A new nanosafety paradigm for the PRE-FIM strategy will also be developed using comprehensive QSAR, microfluidic, and geneic/epigenetic approaches to characterize the GEMNS theranostic contrast/drug candidates compliant with regulatory requirements.

4.2.3. Research grants

[Pro11] **Design and Optimization of Radiation Detectors Sub-THz based on MOS Transistors** (Projektowanie i optymalizacja detektorów promieniowania sub-THz zbudowanych w oparciu o tranzystory MOS).
Wojciech Gwarek, P. Kopyt;
OPUS Project
Mar. 01, 2013 – Mar. 01, 2017
Funded by the National Science Center

The main goal of this project is to take a systematic attempt to describe the phenomena occurring in the silicon detector sub-THz radiation consisting of a MOS transistor with an integrated antenna, taking into account the description of the phenomena occurring not only in the channel of the transistor but also in the surrounding fields contact and even wire connections is crucial for effective design of future experiments this area of knowledge. As a tool for conducting such analyzes, it is proposed to build electromagnetic (EM) coupled model based on FDTD algorithm.

[Pro12] **Development of a Prototype Radar Fire Control Multi-phase Scanning Beam in Two Planes for a Set of Medium-range Missile OP, Codenamed Vistula** (Opracowanie prototypu radaru wielofunkcyjnego kierowania ogniem ze skanowaniem fazowym wiązki w dwóch płaszczyznach dla zestawu rakietowego OP średniego zasięgu, kryptonim WISŁA).
Wojciech Wojtasiak, D. Gryglewski;
Jan. 28, 2013 – Dec. 18, 2020
Funded by the National Centre for Research and Development

The main goal of this project is to design a conception and project of N/O module with 10 W element radiating at X band, taking into account the limitations of raster scanning antenna radiating elements in a wide sector in both planes.

[Pro13] **The Non-invasive System for Monitoring and Analysis of Electricity Consumption in the Area of the End-user** (Nieinwazyjny system monitorowania i analizy zużycia energii elektrycznej w obszarze użytkownika końcowego).
Wiesław Winiecki, R. Łukaszewski, K. Liszewski, R. Kowalik, P. Bilski, A. Buchowicz, G. Galiński, P. Olszyna;
NIALMON
Nov. 01, 2013 – Sept. 30, 2016
Funded by the National Centre for Research and Development

The aim of the project is to develop and verify a model of the system, which will enable non-invasive monitoring and analysis of energy consumption in the area of end-user using the data from one main energy meter. The system uses a method of automatic identification electricity consumers (marked: OEE), allowing it to out of the total energy consumed in the apartment could be isolated portion of the energy used by individual consumers. The main element of the system is the intelligent analyzer of energy consumption (central processing unit). Through direct communication with the main counter, the system will have information about the total energy consumed in the apartment, and the use of these algorithms to identify OEE, based on specific profiles OEE, will be able to identify the individual OEE. The system will be able to analyze information, process and visualize them to the user on different devices.

[Pro14] **Wideband Radiocommunication Recorder** (Szerokopasmowy rejestrator radiokomunikacyjny).

Józef Modelski, W. Wojtasiak, D. Rosołowski, P. Korpas, T. Kosiło, K. Snopek, D. Gryglewski;
Dec. 20, 2013 – Dec. 19, 2016
Funded by the National Centre for Research and Development

The project is carried out at studies on the implementation of the broadband receiver provided the use of components with the best possible performance (linearity, dynamics processing) allowed by the current technological advances. were tested devices designed for broadband collection and analysis of signals in the range of UHF / SHF and important aspects of the design of the processing of A / C. The result of the work will be to develop a broadband radio communications recorder using the OIF and superheterodyne architecture with digital second intermediate.

[Pro15] **Development of Integrated Functional Block for Millimeter-Waves Applications Realized in the LTCC Technology** (Rozwój zintegrowanych bloków funkcjonalnych dla aplikacji na fale milimetrowe realizowanych w technologii LTCC).
Yevhen Yashchyshyn, P. Bajurko, K. Derzakowski, S. Kozłowski, K. Godziszewski, P. Piasecki;
Sept. 01, 2015 – Aug. 31. 2018
Funded by the National Centre for Research and Development

The aim of the project is to develop design methods for implementation and integration of millimeter-wave systems realized in the LTCC (Low Temperature Co-fired Ceramic) technology. Several building blocks of wireless millimeter-wave systems operating in the frequency band between 20 and 140 GHz will be developed: novel antennas and antenna-arrays, transmission lines, passive elements (e.g. couplers, filters). A variety of interconnect techniques (e.g. wire-bonding) between the chip and the planar transmission lines will be analyzed, including matching structures. The goal of the project is to achieve a level of technical maturity of impelementation and integration of functional blocks allowing an industrial impelementation. The results of the planned research will significantly improve capabilities of Polish microelectronics industry and academia in the area of design and manufacturing of modern millimeter-waves systems.

[Pro16] **Sub-THz Active 3D Scanner for Counterterrorism Purposes** (Aktywny sub-THz skaner 3D do zastosowań antyterrorystycznych).
Yevhen Yashchyshyn, P. Bajurko, K. Derzakowski, S. Kozłowski, G. Bogdan;
Sept. 01, 2015 – Aug. 31. 2018
Funded by the National Centre for Research and Development

The aim of the project is to develop a demonstrator security scanner operating at sub-THz band for remote detection of dangerous objects carried by potential terrorists. The planned device will be a multi-pixel active multi-static radar, built on silicon chips operating at a frequency of 120 GHz. Planned demonstrator system parameters are far beyond the current state of knowledge and techniques of the world. These parameters will be achieved through innovative solutions of its individual components. The project will implement consortium consisting of leading Polish technical universities and research institutes, and the new Polish company (start-up) operating in the field of advanced microelectronic technologies. This cooperation will enable the efficient transfer of knowledge between universities and entrepreneurs.

[Pro17] **Full-Wave Electromagnetic Modeling of Coherent Radiation in Electrically-Pumped Metal-Clad Semiconductor Micro--Lasers with a Folded Metallic Resonator** (Pełnofalowe modelowanie elektromagnetyczne zjawiska generacji promieniowania koherentnego w pompowanych elektrycznie laserach półprzewodnikowych z metalizowanym rezonatorem składanym).
Bartłomiej Salski, P. Kopyt, M. Krysicki;
Sept. 16, 2015 – Sept. 15, 2018
SONATA Programme
Funded by the National Science Center

The main goal of the project will be the research on a complete time-domain computational model of coherent radiation in electrically-pumped metal-clad semiconductor micro-lasers with a folded cavity. The model will account for the drift and diffusion of carriers, rate equations representing active material, and Maxwell curl equations solving radiation of generated electromagnetic fields. Coupling of all those phenomena in one computational algorithm will be the novelty when compared to alternative solutions known in literature. The elaborated method will be applied to the research on a new type of metal-clad semiconductor lasers with a prism-like folded micro-cavity.

[Pro18] **Electromagnetic Method of Estimating the Degree of Penetration in the Process of Proppant Fracturing** (Metoda elektromagnetyczna estymacji stopnia penetracji propantu w procesie szczelinowania).
P. Miazga;
EMPROP, Blue Gas Program
Dec. 01, 2014 – Nov. 30, 2017
Funded by the National Centre for Research and Development

The project is aimed at verification of using magnetic proppants for characterization of propped fractures which resulted from hydraulic fracturing. The idea is to perform magnetotelluric (MT) measurements on various stage of this process. The project will verify if the magnetic proppant will change the measurements in such way that the differential image will provide information about the volume or dimensions fractures. The project is carried out at PGNiG, AGH University of Science and Technology, Gdańsk University of Technology, the Institut of Electronic Systems, WUT, the Institute of Ceramics and Building Materials. The project will involve interdisciplinary research in geophysics, materials science, electronics and information science. Expected major outputs of the project are: software tools for simulaton of subsurface electromagnetic wave propagation, software tools and methods of reduction and enhancement of MT measurements resolution, empirical verification of the method in Poland's conditions.

[Pro19] **Methods of Protection and Defense Against the HPM Impulses** (Metody i sposoby ochrony i obrony przed impulsami HPM).
Paweł Kopyt, M. Piasecki;
Dec. 31, 2014 – Dec. 29, 2020
Funded by the National Centre for Research and Development

The project is elaborated in the co-operation with the Military University of Technology, Wroclaw University of Technology, PIT – Radwar Stock Company, Radio Marketing Ltd., the Air Force Institute of Technology, and Pol-Spec-Tech-Service Company. In the frame of the project it is planned to conduct research on the development of methods and means of protection and defense equipment, military equipment and facilities from the destructive effects of HPM pulses particularly, in terms of security of communication equipment, radar equipment, and manned and unmanned facilities and platforms. The project involves testing the impact of the biological effects of HPM pulses of high--frequency and low-frequency microwave. As a result of this work, the main objective of the project is to develop absorbers for different frequency ranges, in different forms and consistencies depending on the needs developed to protect and defend against HPM pulses. The first stage is to take place in the form of technology demonstrators, and in the second stage, in the context of development work is assumed to develop their prototypes, programs and methodologies qualification tests. Design qualification tests are complete absorbers, to develop methods and ways to protect and defend, develop medical instructions concerning medical effects of HPM pulses, Norm Defence for absorbers, as well as user security communication equipment, radar equipment, and manned and unmanned facilities and platforms.

[Pro20] **Microwave Stun Weapon** (Mikrofalowa broń obezwładniająca).
Piotr Bogorodzki, Y. Yashchyshyn, E. Piątkowska–Janko, K. Godziszewski, B. Kossowski, J. Orzeł;
Dec. 30, 2014 – Dec. 29, 2023

Project on microwave stun weapon (MBO) provides in its first stage of the development of a high-power demonstrator device generating pulses of microwave (HPM), acting on continuous wave in the frequency range 70-95 GHz, as a non-lethal weapon strength of living, as well as testing of biological and medical effects action and cognition side effects of the impact of this type of radiation on living organisms and implants. If these works are successful, a second phase is planned to begin development work in the context of which developed a prototype device. The next step will be to develop a conceptual design of the system of stun guns, his prototype, programs and research methodologies qualification. The project to complete the qualification tests of the system and the development of medical instruction and Standards Defence concerning the medical effects of pulses MBO. The leader of the project is the PIT-Radwar SA and the partners of the consortium are the following entities: the Wroclaw University of Technology, Warsaw University of Technology and Military University of Technology.

[Pro21] **Measurement System for an Anechoic Chamber at the Faculty of Electronics and Information Technology** (Stanowisko do badań akustycznych w komorze bezechowej Wydziału Elektroniki i Technik Informacyjnych).
Jan Żera, G. Makarewicz;
Jun. 03, 2016 – Dec. 31, 2016
Funded by the Ministry of Science and Higher Education

The project consists in installation of a highly advanced acoustic measurement system in an anechoic chamber located at the Department of Electroacoustics, Faculty of Electronics and Information Technology, Warsaw University of Technology. The measurement system was built around a Brüel and Kjaer PULSE analyzer platform equipped with an acoustic camera, sound level meters, and a sound intensity probe, supported with software for advanced acoustical measurements and numerical sound field simulations. The system also includes a measurement turntable system, an omnidirectional sound source, calibrators, acoustic test fixtures (manikins) and acoustic couplers. The Department's anechoic chamber is among Poland's largest facilities for free-field acoustic measurements. The new measurement equipment significantly improves its scientific research potential and was intended for a large variety of applications in the fields of acoustics, electroacoustics, telecommunications, and multimedia.

4.2.4. Ph.D. grants

[Pro22] **Myocardial Motion Estimation Using Magnetic Resonance Imaging Method** (Metoda badania ruchu mięśnia sercowego przy użyciu technik rezonansu magnetycznego).
Konrad Andrzej Werys;
Oct. 01, 2014 – May, 18, 2016
ETIUDA 2

The aim o f this project was the development of tool to validate motion estimation methods in magnetic resonance imaging. Second objective was an attempt todevelop a new motion estimation method and its validation.

4.3 Projects granted by the University

4.3.1 Statutory projects

[Pro23] **Work on New Microwave Generators for Industrial Applications and Radio Transmitters. Electromagnetic Analysis Including Modeling of Nonlinear and Dispersive Effects** (Prace nad nowymi generatorami mikrofalowymi przeznaczonymi do przemysłowych urządzeń dużej mocy oraz nadajników systemów radiowych. Metody analizy elektromagnetycznej z uwzględnieniem efektów dyspersyjnych i nieliniowych).
Wojciech Gwarek, S. Rosłoniec, B. Salski, W. Wojtasiak, M. Celuch, D. Rosołowski, D. Gryglewski, P. Kopyt, P. Korpas, P. Miazga, M. Sypniewski, M. Krysicki, M. Góralczyk, D. Kuchta, T. Karpisz, M. Lubiejewski;
Jun 01, 2015 – Nov. 30, 2016

In the electromagnetic modeling part the work concentrated on several different aspects including nonlinear effects in fibers leading to the effects of supercontinuum, acceleration of computer simulations with graphic cards (GPU), and enhancement of full-wave modeling accuracy of semiconductor devices including very thin layers. The team also cooperated in preparing a fundamental publication in Nature Science Report including a thorough explanation of the physical effects in YIG resonators (so far not known despite wide applications of such resonators for more than 50 years). The team continued investigation of

the automated radio-frequency scanner for non--destructive testing of carbon-fiber-reinforced polymer composites used in aviation industry. Important part of the work was devoted to development of new GaN HEMT amplifiers for radio transmitters and receivers.

[Pro24] **Audiovisual Networked Hybrid Systems** (Inteligentne, sieciowe systemy hybrydowe).
Krystian Ignasiak, W. Skarbek, G. Pastuszak A. Buchowicz, G. Galiński, J. Naruniec, M. Kowalski, A. Abramowski, M. Trochimiuk, G. Gwardys, D. Grzywczak;
Jun. 01, 2015 – Nov. 30, 2016

The work was the continuation of the development of elements of the new system for digital TV coding including audio and video compression circuits based on the MPEG-4 (H.264/AVC and AAC) standard. Within the works, some functional blocks of a software video coder for H.264/AVC were developed based on the modularity concept. Getting fast hardware realizations of audio and video coding algorithms and their implementation in FPGA devices enable the verification of the algorithms in real-time conditions. Particularly, hardware PCB devices were used to validate designs. They include FPGA coupled external memories, ADC/DAC audio/video converters, and supply circuits. The design methodology of audio/video coding was developed for some key codec elements. In particular, the concept of adaptive video coding applied to the motion estimation unit has been enhanced to double the throughput. As for audio coding, the AAC encoder was evaluated with different psychoacoustic models. Codecs implementation efforts tend to the creation of a system of network reconfigurable audio-video nodes, which will allow the demonstration of efficiency and usefulness of particular hardware-functional profiles in distributed real-time audiovisual systems.

[Pro25] **Techniques for Signals Processing in UWB Receivers** (Techniki przetwarzania sygnałów w odbiornikach ultraszerokopasmowych).
Jerzy Kołakowski, J. Cichocki, R. Michnowski, K. Radecki, S. Żmudzin, V. Djaja-Jośko;
Jun. 01, 2015 – Nov. 30, 2016

The project consisted in development and investigation of two UWB receivers: a FPGA based threshold detection receiver and a correlation receiver based on DW1000 chip from Decawave. The correlation receiver was additionally tested in the unilateral UWB positioning system. According to obtained results the receiver allows to achieve localization accuracy better than 10 cm even in multipath conditions. The conducted experiments also showed that positioning system performance strongly depends on the number and localization of anchor nodes included in positioning system infrastructure. UWB maximum indoor transmission range typically varies from several to a few tens of meters. In order to increase receiver sensitivity an external preamplifier was developed. Preamplifier measurements confirm that it can be used for communication range extension, even twice for free space transmissions. Results of investigation proved that UWB correlation receivers can be successfully used in localization systems.

[Pro26] **Radiocommunication Systems in Intelligent Transport** (Systemy radiokomunikacyjne w inteligentnym transporcie).
Józef Modelski, K. Kurek, T. Keller, M. Dąbrowski, M. Darmetko, K. Derzakowski;
Jun. 01, 2015 – Nov. 30, 2016

The aim of the work was to analyze the possible use in intelligent transport of radiocommunication systems, in particular vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) links. Three main topics have been considered: systems for access of mobile users to multimedia services; project of a system facilitating ride of emergency vehicles in urban traffic jam conditions; project of a sensor system informing vehicle drivers about free parking spots.

[Pro27] **Improvement of Output Resonant Circuits for Conventional and Switch-Mode Semi-Wideband Power Amplifiers** (Doskonalenie wyjściowych obwodów rezonansowych do quasi-szerokopasmowych i kluczowanych wzmacniaczy mocy).
Juliusz Modzelewski, H. Chaciński, W. Kazubski, T. Kosiło, M. Mikołajewski;
Jun. 01, 2015 – Nov. 30, 2016

Modern radio transmitters are able to operate in any channel of the frequency band of their radio communications system and a channel is selected only by setting up the operating frequency of the low-power (carrier) generator. Thus, in such transmitters the amplifiers of modulated signals should be able to operate in any channel without the user intervention. In radio communications systems that meet $f_{max}/f_{min}<2$ condition, the power amplifier which amplifies signals of all channels in the system can be built as semi-wideband resonant amplifier with non-sinusoidal current of its transistor. As a part of the research project a procedure for designing output circuits of semi-wideband class AB, B, and C power amplifier was developed. The proposed method ensures that designed amplifiers have both the required frequency band and low level of harmonic emissions. The design procedure is based on a standard design method of LC passive filters driven by a sinusoidal current source. It was proved that the best results are obtained if in the designed amplifier its output circuit is a band-pass Butterworth filter with a wideband matching transformer. The proposed procedure was verified experimentally by designing and building an output circuit for a 40W semi-wideband VHF-FM power amplifier operating in the 87,5 – 108 MHz range. The power efficiency of the measured filter was limited to 73.5% and its 1-dB band to 90 – 107 MHz, which resulted from low quality factors of the used small value (nH) inductors. Switch-mode Class E tuned power amplifiers usually operate with high efficiency in a relatively narrow frequency band. Variation of the Class E amplifier operating frequency results in a wide range modulation of its output power. This phenomenon is utilized to regulate output power in dc/dc converters and dc/ac inverter with Class E amplifiers. However, in radio transmitters their output power should be possibly constant over the whole operating frequency band. As a part of this project an output circuit for a semi-wideband Class E amplifier was proposed. The circuit comprises three sections: a parallel circuit, a matching circuit and a three-stage band-pass Chebyshev filter. The proposed circuit was

optimized and verified by building an experimental 12W Class E amplifier operating in CB-band (24-30 MHz). Measured parameters of the amplifier proved its good efficiency (from 83% to 95%) and an almost constant level of its output power throughout the whole frequency band. The built amplifier requires further optimization because the measured level of harmonic emissions in the output signal was still above the regulation limits.

[Pro28] **Methodological and Meta-Metrological Aspects of Experimental Data Interpretation** (Metrologiczne i meta-metrologiczne aspekty interpretacji danych eksperymentalnych).
Roman Z. Morawski, A. Miękina, A. Podgórski;
Jun. 01, 2015 – Nov. 30, 2016

The primary objective of the project is related to the methodological aspects of metrology, in particular of the design and implementation of algorithms for calibration of measurement channels and reconstruction of measurands (*i.e.* generalised quantities to be measured); the project is also aimed at upgrading the corresponding research infrastructure (both hardware and software). The results of the project include: selected methods for designing algorithms for processing data from radar sensors, depth sensors and accelerometric sensors, as well as a bibliographic sub-database concerning both methods of measurement data processing and metametrological aspects of their study. The results of the research accomplished have been partially published in five conference papers.

[Pro29] **Chosen Theoretical Problems and Optimization of Signal Processing Algorithms in Radiocommunication Systems** (Wybrane zagadnienia teoretyczne i optymalizacja algorytmów przetwarzania sygnałów w systemach radiokomunikacyjnych).
Kajetana Snopek, S. Kozłowski, A. Bilski, Ł. Błaszczyk;
Jun. 01, 2015 – Nov. 30, 2016

The subject matter of the research was theoretical and experimental studies in three independent domains: hypercomplex multidimensional signals, indoor localization methods and signal processing algorithms in SDR systems. First, the properties of the Octonion Fourier Transform (OFT) of real functions of three variables were studied. Symmetry relations for the OFT were derived using the notion of octonion involutions. Also the octonion analogues of Parseval's and Plancherel's theorems were derived. Those results, along with the shift property of the OFT, lead to the proof of the octonion version of the Wiener-Khintchine theorem and definitions of autocorrelation function and a power spectral density of a signal. Secondly, the localization indoor method using Kalman filtering was analyzed and the measurements of indoor dynamic localization were performed with Eddystone beacons (produced by Kontakt.io) and a typical Android smartfon. At last, literature search concerning signal processing problems in SDR receivers was performed and the algorithm of frequency synchronization for communication with LEO satellites was proposed. The algorithm includes a nonlinear operation for recovering carrier wave from the received signal, software 2nd order type 2 phase locked loop for tracking the recovered carrier, and a correction block for removing frequency shift from the received signal. Computer simulations were performed to investigate algorithm's behaviour. Additionally, execution time was measured to determine maximal symbol rate of a signal to be processed.

[Pro30] **Development of Methods for the Electrical Appliances Identification in the Energy Consumption Monitoring Systems** (Rozwój metod identyfikacji odbiorników w systemach monitorowania zużycia energii elektrycznej).
Wiesław Winiecki, P. Bilski, R. Łukaszewski, K. Mroczek, A. Wójcik, P. Zawistowski;
Jun. 01, 2015 – Nov. 30, 2016

The method for calculating feature vectors of electrical appliances in the non-intrusive approach to determine the end-user electrical energy consumption was proposed. The novel methodology of determining feature vectors for electrical appliances using their immitances was implemented. The method allows for elimination of the power network load influence on the parameters describing appliances. The method of the multi-state appliances identification (such as the washing machine or dishwasher) was proposed. For this purpose the unsupervised learning method was designed, isolating the separate states of the appliance work regime. Next, the supervised learning algorithm was applied to distinguish between various states of such an appliance, as well as simpler, two-state devices. The need to determine optimal values of both methods' parameters was noticed, to maximize the appliance identification accuracy. Results of the presented research were presented on Polish and international conferences, including the publication in Proc of SPIE, affiliated in the Web of Science database.

[Pro31] **Investigation of Antennas and Materials in Sub-Terahertz Range** (Badanie anten i materiałów w zakresie subterahercowym).
Yevhen Yashchyshyn, P. Bajurko K. Derzakowski, A. Łysiuk, K. Godziszewski, G. Bogdan, P. Piasecki;
Jun. 01, 2015 – Nov. 30, 2016

In the Laboratory of Antennas and sub-THz Technology a unique infrastructure was created. That infrastructure allows to make measurements of material properties and scattering parameters in sub-terahertz range. The only limitation of the setup was the lack of capabilities of radiation patterns measurements. Therefore as part of the project appropriate rotary stage and measurement techniques were developed and implemented in the laboratory.

[Pro32] **Modern Techniques in Nuclear and Medical Electronics** (Nowoczesne techniki elektroniki jądrowej i medycznej).
Krzysztof Zaremba, P. Bogorodzki, P. Brzeski, G. Domański, M. Dziewiecki, T. Jamrógiewicz, B. Konarzewski, R. Kurjata, J. Marzec, J. Kryszyn, W. Obrębski, T. Olszewski, J. Orzeł, E. Piątkowska-Janko, D. Radomski, B. Sawionek, W. Smolik, R. Szabatin, M. Ziembicki, W. Gradkowski, B. Kossowski, A. Rychter, K. Werys, M. Wieteska, P. Wróblewski;
Jun. 01, 2015 – Nov. 30, 2016

- *Hyperpolarised contrast in NMR tomography*

The aim of the study was to develop and carry out an experiment hyperpolarization of contrast agents containing free radicals using magnetic resonance technology and techniques PEDRI (ang. Proton-Electron Double Resonance Imaging), and electron paramagnetic resonance (EPR called. Electron Paramagnetic Resonance). The study was conducted in low-field 0.23T tomography (Outlook ProView, Philips) under the control of an additional console (Kea2, Magritek). Prepared was set to carry out experiments in aqueous solutions of substances containing free radicals (a technique Relic - ang. Remotely Liquids for Enhanced Image Contrast).

- *Methods of image reconstruction in computed x-ray microtomography*

X-ray microtomography imaging is a technique with high spatial resolution, used to determine the three dimensional distribution of the absorption coefficient of X-ray. The basic application is a study of small biological objects, for example small organisms (insects, small mammals) or stretches of bone tissue. In the context of the work the analysis of the effect of different methods of image reconstruction for image quality of a system for X-ray microtomography has been carried out.

- *Magnetic particle tomography*

This year, work on the subtopic of statutory focused on the following tasks:

- Development of a numerical simulation of generation of magnetization signal of superparamagnetic nanoparticles (harmonics);
- Analysis of magnetic nanoparticles spectroscopy – determination of magnetization curve on the basis of the magnetization signal spectrum.

In the framework of the task 1 the software components for modeling of excitation and response of superparamagnetic nanoparticles in an alternating magnetic field were created. The software enabled to restore the magnetization curve of magnetic nanoparticles on the basis of the frequency spectrum of the signal registered from receiving coils. The spectrum from a numerical simulation or measured using a measurement setup for nanoparticle spectroscopy can be used. The software was a toolbox for Matlab environment.

In the framework of the task 2 the possibility of determining the magnetization curve of magnetic nanoparticles on the basis of the signal spectrum was analyzed. The construction of the laboratory setup for magnetic nanoparticle spectroscopy was started. The solenoid for generating a homogeneous magnetic field in excited volume was modeled and made. It was assumed the ability to create an alternating field with the frequency of 20 kHz and with an amplitude greater than 30 mT, at the power loss of approx. 120 W. Such performance was achieved through the use of litz type wire, which significantly increased the quality factor of the coil. The pair of gradiometic receiving coils was also made. They allow to receive the signal from the nanoparticles, with a significant dumping of the excitation signal.

[Pro33] **New Methods for Testing Quality of Sound Processing** (Nowe metody badania jakości przetwarzania dźwięku).
Jan Żera, Z. Kulka, P. Bobiński, E. Kotarbińska, G. Makarewicz, M. Lewandowski;
Jun. 01, 2015 – Nov. 30, 2016

The project consisted of three research and construction topics. The first part was devoted to design and construction of a digital signal processing unit for audio signals. The system uses SHARC ADSP-21489 signal processor, and consists of four input and output channels and input/output digital lines in AES/EBU format. The second part of the project was dedicated to short-term analysis of linear and non-linear audio signal processing systems. The systems were tested with the nonstationary signals such as music and speech. The third part was devoted to active compensation of noise and distortion in audio channels what is an important issue for a design of a high-quality audio equipment. In result of this part of the project, a dedicated software for simulation of active reduction of noise was developed.

4.3.2. Projects granted by the Rector

[Pro34] **Universal System for Bioelectric Signals Acquisition** (Uniwersalny system akwizycji sygnałów bioelektrycznych).
Grzegorz Domański;
May 30, 2016 – Dec. 31, 2016

The aim of the project was to construct a universal system for bioelectric signals acquisition. The system comprises a bioelectric signal amplifier with adjustable both gain and frequency passband, the analog-to--digital control system, and the wireless transmission. Acquisition and visualization is achieved by means of the developed program with a graphical user interface. Developed system provides measurement of bioelectric signals in at least one differential channel (three electrodes).

[Pro35] **Survey of Air Pollution Changes as a Function of Height Using Stratospheric Balloon** (Badanie zmian poziomu zanieczyszczeń atmosfery w funkcji wysokości z wykorzystaniem balonu stratosferycznego).
Krzysztof Kurek;
May 30, 2016 – Dec. 31, 2016

The aim of the work was project of platform for stratospheric balloon missions to collect data from sensors placed in higher atmosphere layers. The platform consists of microprocessor controller, radiocommunication module, power supply module, GPS module and exchangeable sensors connected to controller. In current mission set of sensors to measure air pollution has been used, considering greenhouse gases CO_2 and CH_4.

[Pro36] **Wideband System for Measuring and Acquisition of Non-Destructive Testing of Conductive Composite Materials** (Szerokopasmowy system pomiaru i akwizycji danych do badań nieniszczących materiałów kompozytowych).
Bartłomiej Salski;
May 30, 2016 – Dec. 31, 2016

The aim of the project was to design a system controller for quick, wideband, real-time, non-destructive testing (NDT) of conductive composite materials. FPGA board was used to control the measurement process. Getting to know the architecture as well as programing the board was main purpose of the project. Test signal is generated with use of direct digital system (DDS) board, providing high flexibility in the rapid and precise generation of test waveforms of any shape. Signal generated by DDS board is then supplied to the current-voltage converter with precision

resistor included in a feedback loop which is directly connected to the inductive sensor. The other end of the sensor is connected to a similar degree of voltage to current converter. Furthermore the harmonics generated by the DDS are filtered out by the low pass filter just before signal sampling. Sampling and signal processing is performed by the high speed analog to digital converter ADC as well as dedicated FPGA board. The use of an FPGA allows to control all system components and gives big flexibility in choosing the total number of measurement channels that can be simultaneously measured while the system array of sensors.

4.3.3. Projects granted by the Dean

[Pro37] **Laboratory System for Measuring, Recording and Analyzing Audio Signals in Real Time** (Laboratoryjne stanowisko do pomiarów, rejestracji i analizy dźwięku).
Marcin Lewandowski;
May 16, 2016 – Dec. 31, 2016

The aim of this work was to develop a system for measuring, recording and analyzing sound according to IEC standards. System is able to analyze amplitude, frequency and time-frequency parameters of audio signals played through speakers and headphones in real time.

4.4 Other projects

[Pro38] **Distributed System for Concrete Curing Temperature Measurement** (Rozproszony system do pomiaru tempratury tężejącego betonu).
Jerzy Kołakowski, J. Cichocki, R. Michnowski;
Jul. 01, 2015 – Dec. 15, 2016
Funded by MOSTOSTAL Warszawa

The development system was intended for outdoor measurements of concrete temperatures, ambient temperature and humidity.

[Pro39] **Expert Services in order to Implement the Project "Hybrid CT Scanner to Examine Buildings Moisture and Condition** (Usługi eksperckie w celu realizacji projektu "Tomograf hybrydowy do badania zawilgocenia i stanu budynków").
Waldemar Smolik;
Oct. 26, 2015 – Feb. 28, 2018
Funded by Netrix S.A.

The project involves the creation of a CT system (measuring device and software for interpreting the results of measurement) using both impedance tomography and CT capacitance to a spatial analysis of the degree of damp walls.

[Pro40] **Hybrid CT Scanner to Examine Buildings Moisture and Condition** (Tomograf hybrydowy do badania zawilgocenia i stanu budynków).
Waldemar Smolik, P. Brzeski, J. Kryszyn, T. Olszewski, R. Szabatin;
Oct. 01, 2015 – Feb. 28, 2018
Funded by Netrix S.A.

The project is carried out at Netrix S.A. Research and Development Centre in Lublin. The objective is to build a multimodal electrical tomograph which enables measurement of conductivity and permittivity spatial distribution. The new image reconstruction methods are also developed. The device will be used for imaging of dumped wall. The prototype device ECITE (Electrical Capacitance and Impedance Tomograph), will enable simultaneous measurement of capacitance and impedance using active surface electrodes. CT hybrid is a modular, compact, configurable, allowing work in various measuring systems.

[Pro41] **Development of Device Operating in a Magnetic Field of 3T Scanner for Delivering Small Quantities of Liquid Substances with the Dedicated Functional Studies** (Opracowanie urządzenia działającego w polu magnetycznym skanera 3T, służącego do podawania niewielkich ilości płynnych substancji wraz z opracowaniem schematu dedykowanych badań czynnościowych).
Piotr Bogorodzki, E. Piątkowska-Janko, B. Kossowski, J. Orzeł;
Oct. 07, 2015 – Jan. 31, 2016
Funded by Instytut Biologii Doświadczalnej im. M. Nenckiego (Nencki Institute of Experimental Biology).

The main goal of this project was to construct the instrumentation for medical investigations. The project is a part of the preclinical researches undertaking in the Nencki Institute of Experimental Biology.

[Pro42] **Design the Narrow-band Antennas Integrated to HEMT Transistors at Sub-THz Band** (Zaprojektowanie wąskopasmowych anten zintegrowanych z tranzystorami typu HEMT, pracujących w paśmie sub-THz).
Paweł Kopyt;
Feb. 16, 2016 – Jun. 30, 2016
Funded by HFT Opto Ltd.

The main aim of this project was to elaborate the narrow-band antennas integrated with the HEMT transistors. Designed antennas were worked in sub-THz band. Few technological aspects were taken into account, including influence of material characterization and layer inspection. Appropriate simulation analysis and experimental verification were performed.

[Pro43] **Development of the Meta-Mast with Self--Powered Wind Energy with New Performance Features and a Multi-Discipline Applicaton** (Opracowanie koncepcji metamasztu z własnym zasilaniem energią wiatrową o nowych parametrach funkcjonalności i wielobranżowym zastosowaniu).
Jacek Jarkowski;
Apr. 18, 2016 – May 31, 2016
Funded by TOWERNET SYSTEM Ltd.

Details of the project cannot be published due to non-disclosure agreement with the contractor.

[Pro44] **Development and Realization of Radio over Fiber Modules** (Opracowanie oraz wykonanie modułów do transmisji radiowo--światłowodowej).
Yevhen Yashchyshyn, K. Godziszewski, A. Łysiuk, A. Skrzypkowski;
Apr. 15, 2016 - Jun. 30, 2016
Funded by SIRC Ltd.

The aim of the project was to develop and realize two sets of modules for Radio over Fiber transmission. The first set is dedicated for wired unidirectional transmission in the frequency range up to 4 GHz and

consists of one transmitting and one receiving electro-optical modules. The second set is used to realize wireless bidirectional RoF link. This link is composed of transceiver module and bidirectional photonic antenna for 2.3-2.9 GHz band.

[Pro45] **28-GHz Reconfigurable Beamforming Antenna Based on PIN Diodes** (28-GHz konfiguracja kształtowania wiązki oparta na diodach PIN).
Yevhen Yashchyshyn, G. Bogdan;
Aug. 01, 2016 – Jan. 31, 2017
Funded by Korea Institute of Electronics and Telecommunications (Instytut Elektroniki i Telekomunikacji Republiki Korei).

A concept of a reconfigurable antenna is based on a reconfigurable slot aperture, which is placed instead of a narrow wall of a metallic rectangular waveguide. A standard rectangular waveguide WR-28 has been used. Reconfigurable slot aperture is formed as an array similar to a waveguide slot antenna but with S-PIN diodes embedded into each slot. The distance between neighboring slots on the aperture has to be chosen in a special manner in order to provide required direction of the beam.

[Pro46] **Scientific Studies, Projects and Electronic Devices Optimization for 'Brain--Computer Interface' Project** (Prace badawcze, projekty i optymalizacja układów elektronicznych i elektrod na potrzeby realizacji projektu "Interfejs mózg-komputer").
Piotr Bogorodzki, E. Piątkowska-Janko, B. Kossowski, J. Orzeł;
Aug. 03, 2016 - Mar. 3, 2018
Funded by BRAINTECH Ltd.

The main goal of this project is to optimize electronic devices for the purpose of brain-computer interface project. These devices will be used in visual simulation of activity the main parts of the human brain.

[Pro47] **Scientific Studies, Industrial Investigations, Projects and Prototype of Electronic Device for 'Brain-Computer Interface' Project** (Prace badawcze, badania przemysłowe i prace rozwojowe – projekty i prototypy elementów elektronicznych na potrzeby realizacji projektu „Interfejs mózg--komputer".
Piotr Bogorodzki, E. Piątkowska-Janko, B. Kossowski, J. Orzeł;
Aug. 03, 2016 - Dec. 31, 2018
Funded by BRAINTECH Ltd

The main objective of this project is to conduct research studies and construct the prototypes of EEG amplifier and BCI appliance device enable to conduct simultaneous measurement of brain activity.

[Pro48] **Design and Implementation of HD--Signal-Converters Prototypes** (Opracowanie oraz wykonanie zestawu prototypów przemienników sygnału HD).
Grzegorz Pastuszak;
Oct. 3, 2016 – Dec. 31, 2017
Funded by CAMSAT Gralak Przemysław

The project is focused on the development of signal converters between three types of high definition video analog signals: AHD, TVI and CVI. The result will be the device able to accept any of the three formats and to generate the output signal with one selected format. The device should support the automatic adaptation to the input format, the resolution scaling, the PTZ control, and the cooperation with radio devices.

[Pro49] **Expertise on Electromagnetic Field Level Near NEMP Mobile Installation** (Ekspertyza dotycząca wartości natężenia pola elektromagnetycznego występującego w pobliżu instalacji typu mobilnego NEMP).
B. Salski, P. Kopyt;
Sept. 10, 2016 – Nov. 15, 2016
Funded by Wojskowe Zakłady Łączności nr 1 S.A. (Military Communication Works no. 1, Joint Stock Company)

Details of this project cannot be published due to non--disclosure argeement with the contractor.

[Pro50] **RNK Elements Construction** (Wykonanie elementów RNK)
Wojciech Wojtasiak, D. Gryglewski;
Oct. 24, 2016 – Nov. 25, 2016
Funded by Wojskowe Zakłady Elektroniczne S.A. (Military Electronic Works, Joint Stock Company).

The main goal of this project was to construct two signal processing blocks replacing specialized aiming proccessing card and rocket proccessing card, TES packet, modular command control, synchronizer, aim channel amplifier IF and visual rocket channel amplifier. It was made of semicondu-ctor analog and digital elements also PC104 CPU.

4.5 Other activities

4.5.1 Scholarship for the outstanding young scientist granted by the Ministry of Science and Higher Education

Bartłomiej Salski;
Oct. 07, 2015-Oct. 07, 2018

The scholarship recipient research interests focused on the electromagnetic modelling. The main aim is to detect defects in composite materials and components.

4.5.2 Partnership

4.5.2.1 International Co-operation

COST IC1101 - Optical Wireless Communications - An Emerging Technology (OpticWise)
Y. Yashchyshyn – MC member
2012-2016

This COST Action serves as a high-profile consolidated European scientific platform for interdisciplinary OWC research activities, spanning from characterization of diverse propagation media to modeling, design and development of devices, components, algorithms/protocols and systems. It makes significant contributions to the fundamental scientific understanding, technical knowledge, engineering design and applications while promoting community awareness of this emerging field. Development of novel and efficient communication technologies resulting from integrated research activities made possible through this Action is a significant enabler for future generation heterogeneous communication networks supporting a wide range of wireless services/applications.

COST IC1102 - Versatile, Integrated, and Signal--aware Technologies for Antennas (VISTA)
Y. Yashchyshyn – MC substitute member

2012-2016

This COST Action identifies key research topics, facilitating the networking and coordination between different R&D teams. The objectives are to assess the needs for the new technologies and applications, to foster the development of radiating systems in green, smart environments, to provide the necessary supporting technologies and to promote the career start of young researchers.

4.5.2.2 International Co-operation

CC-Link

Since 12 May 2005 the Institute of Radioelectronics and Multimedia Technology has been a formal member of the CC-Link Partner Association – the world--wide organization of industrial and research institutions working on the development and applications of CC-Link (Control & Communication Link) – a field network system that processes both the control and information data at high speed, to provide efficient integrated factory and process automation. The collaboration with the Association is realized by the Division of Nuclear and Medical Electronics.

National Co-operation

MultiShow Cluster

The Institute of Radioelectronics and Multimedia Technology has been designed a cross-regional initiative called: "MultiShow Solution for Sports & Leisure Facilities Cluster"; Partner - Polish Association for Sports and Leisure Facilities IAKS Polska is a professional adviser in the range of designing, building of sport and recreation facilities (among other things: project supervisions, preparing an expert opinion, conceptions, estimations, consultations, facilities inspections, and workshop procedures) and also their managing. The co-operation with IAKS is realized by the Division of Television.

IUSER

The new established science and technology platform: "Intelligent Devices and Systems for Distributed Power Generation" is carried out at Institute of Radioelectronics and Multimedia Technology, Military University of Technology, National Institute of Telecommunications, Military Communication Institute, National Chamber of Electronics and Telecomunications, TP SA., Institute of Electron Technology. The main aim of this project is to conduct the research on technologies and products, the implementation of which will create a market opportunity for the development of distributed generation based on renewable energy sources.

Intelligent Transport

The new established science and technology platform is carried out at Faculty of Electronics and Information Technology (Institute of Radioelectronics and Multimedia Technology, Institute of Telecommunications), Faculty of Transport, Faculty of Administration and Social Sciences, Faculty of Automotive and Construction Machinery Engineering. The main aim of this project is to realize the scientific researches in the field of telecommunication and information systems and methods of information in an intelligent transport.

4.5.3 Scientific networks

Polish Network of Neutrino Physics (Polska Sieć Neutrinowa)

In 2006, the Faculty of Electronics and Information Technology joined the Polish Network of Neutrino Physics. The network compreses several institutes and laboratories working in the field of development of experimental neutrino physics. The Faculty is represented in the network by the Division of Nuclear and Medical Electronics, which has a long-term experience in collaboration with high energy physics (NMC, SMC, COMPASS) and neutrino physics (ICARUS, T2K) experiments.

Polish Network of Particle Astrophysics
(Polska Sieć Astrofizyki Cząstek)

In 2006 the Faculty of Electronics and Information Technology joined the Polish Network of Particle Astrophysics. The main goal of the organization is to create a frame for the research collaboration of several institutes and laboratories in the field of development of advanced experimental methods for particle astrophysics. The Faculty is represented in the network by two research groups: from the Institute of Electronics Systems and from Institute of Radioelectronics and Multimedia Technology – namely from the Division of Nuclear and Medical Electronics.

HyperMR - European Network for Hyperpolarization Physics and Methodology in NMR and MRI – TD1103

In 2012 the Faculty of Electronics and Information Technology, Institute of Radioelectronics and Multimedia Technology (the Division of Nuclear and Medical Electronics) joined the project realized in the frame for the research collaboration of several Polish and foreign institutes. The main aim of this Action is to stimulate and accelerate collaborations and joint research efforts between European groups into hyperpolarization physics and methodology with the goal to develop robust strategies for sensitivity enhancement in NMR and MRI. Coordinated short-term scientific missions (STSMs) will make it possible to fully exploit the potential of unique scientific instrumentation which already exists in a number of European groups. The scientific programme is organised into 5 different working groups that focus on key issues related to the topic of the Action. The scientific programme is supported by a wide range of research groups thus generating a high added value for the European research landscape

4.5.4 Student research groups

Space Engineering Student Scientific Group
Krzysztof Kurek – tutor.

Space Engineering Student Scientific Group – SKIK (in Polish Studenckie Koło Inżynierii Kosmicznej) was formed in 2004. Members of SKIK participated in different international and internal educational space projects. i.e. ESEO, PW-Sat, BOBAS balloon missions. Now, the group start activity with new members, preparing the next balloon mission. Now activity of the Group is focused on realization of stratospheric balloon missions to measure air pollution.

Biomedical and Nuclear Engineering Student Scientific Group
Grzegorz Domański – tutor.

Biomedical and Nuclear Engineering Student Scientific Group (in Polish Studenckie Koło Inżynierii Biomedycznej i Jądrowej Biomedyczni – (http//www.

ire.pw.edu.pl/biomedyczni) was formed in Dec. 2005 by a group of students from Biomedical Engineering. The group worked on software enabling determination of longitudinal relaxation time on the basis of a series of images with different inversion time (TI). The "Arduino for biomedical applications" project has been initiated to develop student interests in the design of new electronic systems, software, and use them in biomedicine. The main objective of the project group is to get acquainted with the electronic platform Arduino programming environment for creating low-cost, flexible and easy-to-use devices. The acquired knowledge and skills will be use at a later stage of the project to develop and implement a multi-functional system for biomedical use, based on the Arduino platform and additional electronic components.

Innovative Information Technologies Student Scientific Group
Przemysław Miazga – tutor.

The scope of interest of the Students' Circle for Innovative Informatics Technologies (KNITI) is the application of .NET technologies in mobile devices programming. In 2016 KNITI organized 3 courses for students of our university, two courses on basics of C# programming language (12 presentations x 2 hours each) and one course on advanced Windows 8 programming for mobile devices (10 x 2 hours) with over 250 participants. Students of the Group participated in many programming events and contests eg. in Microsoft Imagine Cup, hackatone Night of The Living Devs. The Circle is the organizer of K-Night LAN Party programming marathon.

Student Scientific Group of Web Application
Jacek Naruniec – tutor.

The main goal of the Student Scientific Group of Web Application is to develop competence in HTML, CSS and JavaScript fields by creating projects of web applications and web games. We are focused on regular weekly meetings to develop websites and applications, which are currently related to tourism aid. The latest application serves for improving safety in the mountains and help tourists to develop their online society.

4.6 Instrumentation investments

4.6.1 Centre for Biomedical Technology and Medical Physics

Nuclear and Medical Electronics Division (**Krzysztof Zaremba** – head)
2008 - 2016
Founded by European Regional Development Fund (ERDF) in scope of Operational Programme Innovative Economy (POIG).

The project is a part of the CePT (Centre for Preclinical Research and Technology), the biggest biomedical and biotechnological undertaking in Central and Eastern Europe. The CePT project is coordinated by the Medical University of Warsaw in partnership with the University of Warsaw, the Warsaw University of Technology and seven research institutes of the Polish Academy of Sciences. The main objective of the Centre is to establish the network of biomedical engineering and biomaterial technology laboratories which will form the base for scientific research and technology implementation. In this Project participates 8 faculties of Warsaw University of Technology.

4.6.2 Sub-terahertz Technology and Antenna Laboratory

Yevhen Yashchyshyn, P. Bajurko
2010 – 2016
Founded by European Regional Development Fund (ERDF) in scope of Operational Programme Innovative Economy (POIG).

The project is a part of the Faculty Research Centre FOTEH (Photonics and Terahertz Technologies). The project encompasses modernizing of infrastructure of the Antenna Laboratory that enables research on spatial distributions of the electromagnetic field in the millimetre-wave and sub-terahertz range to develop and study of antennas, characterize parameter of materials and designing of the communication, imaging and radar system.

5. TITLES AND DEGREES AWARDED

5.1 Professor Titles

[Prof1] Yevhen Yashchyshyn – promoted to a professor title (Dec. 02, 2016).

5.2 Ph.D. Degrees

[PhD1] Stanisław Adaszewski: "*Virtualization of neuroimaging data access and processing for multisite population brain studies*", Prof. **P. Bogorodzki** (supervisor), Warsaw, Oct. 11, 2016.

[PhD2] Adrian Bilski: *„Metoda diagnostyki złożonych układów analogowych z wykorzystaniem maszyn wektorowych"* (The method of diagnostics the complex analog systems using vector machines), Prof. **W. Winiecki** (supervisor), Warsaw, May 10, 2016.

[PhD3] Piotr Płoński: *„Zastosowanie wybranych metod przekształcenia i selekcji danych oraz konstrukcji cech w zadaniach klasyfikacji i klasteryzacji"* (Application of selected methods for data processing and selection, and features construction in the tasks of classification and clustering), Prof. **K. Zaremba** (supervisor), Ph.D. with honours, Warsaw, May 10, 2016.

[PhD4] Andrzej Rychter: *„Measurement based characterisation and modelling of micropixel avalanche photodiodes",* Prof. **J. Marzec** (supervisor), Warsaw, Nov. 8, 2016.

[PhD5] Adam Strupczewski: *"Śledzenie kierunku wzroku za pomocą zwykłych kamer"* (Commodity camera eye gaze tracking), Prof. **W. Skarbek** (supervisor), Ph.D. with honours, Warsaw, May 31, 2016.

[PhD6] Konrad Werys: *„Cardiac motion analysis method based on cinematographic MRI",* Prof. **P. Bogorodzki** (supervisor), Warsaw, Oct. 18, 2016.

[PhD7] Piotr Zawistowski: *"Metoda projektowania i walidacji oprogramowania systemów pomiarowych z wykorzystaniem języków graficznych"* (Design and validation of measurement systems using graphical programming environments), Prof. **W. Winiecki** (supervisor), Warsaw, Dec. 1, 2016.

5.3 M.Sc. Degrees

[MSc1] Kamil Bińkowski: *„Implementacja sprzętowa modułów dekodera H.265/HEVC"* (Hardware implementation of modules in decoder H.265/HEVC), Assoc. Prof. **G. Pastuszak** (supervisor), M.Sc. degree with honours.

[MSc2] Lidia Chabiera: *"Program do obliczania osłon przed źródłami promieniotwórczymi"* (Program to calculate shields against radioactive sources), Assist. Prof. **G. Domański** (supervisor).

[MSc3] Lidia Chrabąszcz: *„Analiza algorytmów tworzenia oraz walidacji sygnatur genetycznych z przykładami zastosowań do danych z The Cancer Genome Atlas"* (Analysis of algorithms of creating and validating gene signatures with applications to data from the Cancer Genome Atlas), Prof. **P. Biecek** (supervisor).

[MSc4] Michał Ciechański: *„Informatyczna wydajność kwantowa (DQE) sensorów luminescencyjnych strukturyzowanych - model symulacyjny"* (Information quantum efficiency (DQE) of structured luminescent sensors - simulation model), Assist. Prof. **B. Konarzewski** (supervisor).

[MSc5] Andrzej Paweł Ciura: *„Optymalizacja warstwy MAC protokołu WAVE"* (Optimization of MAC level of WAVE protocol), Assist. Prof. **T. Keller** (supervisor).

[MSc6] Łukasz Dąbek: *„Heterodyna do odbiornika szerokopasmowego na pasmo 1÷6 GHz o niskim poziomie szumów fazowych"* (Low phase noise heterodyne for wideband receiver in range 1÷6 GHz), Assist. Prof. **D. Gryglewski** (supervisor).

[MSc7] Maria Wiktoria Dąbrowska: *„Identyfikacja autorów pisma odręcznego"* (Writer identification), Assist. Prof. **J. Putz-Leszczyńska** (supervisor), M.Sc. degree with honours.

[MSc8] Katarzyna Agnieszka Domańska: *"Analiza zjawiska przesunięcia charakterystyk ciśnieniowo - objętościowych ciśnienia wewnątrzczaszkowego podczas i po zakończeniu lędźwiowego testu infuzyjnego"* (Analysis of phenomenon shift of pressure – volume characteristic of intracranial pressure during and after the lumbar infusion test), Prof. **A. Grzanka** (supervisor).

[MSc9] Krzysztof Dowalla: *„Metoda identyfikacji odbiorników energii elektrycznej na podstawie analizy zakłóceń elektromagnetycznych"* (Method of identitifying electricity receivers with EMI analysis), Assist. Prof. **R. Łukaszewski** (supervisor).

[MSc10] Martika Grabowska: *„Telemedyczny system nadzoru farmakoterapii"* (Telemedicine system for pharmacotherapy monitoring), Assist. Prof. **R. Kurjata** (supervisor).

[MSc11] Magdalena Huryn: *„Badanie i ocena narażenia na hałas wykonawców muzyki rockowej i elektronicznej"* (Testing and assessment of noise exposure among rock and electronic music performers), Assist. Prof. **E. Kotarbińska** (supervisor).

[MSc12] Miłosz Jarzynka: *"Opracowanie oraz badanie dwuwymiarowego modulowanego czasowo szyku antenowego"* (Development and measurements of the two-dimensional time–modulated antenna array), Prof. **Y. Yashchyshyn** (supervisor).

[MSc13] Krzysztof Jastrzębski: *"Monitor promieniowania neutronów termicznych"* (A micro processor monitor system for field thermal neutron detector), Prof. **J. Marzec** (supervisor).

[MSc14] Marcin Kołakowski: *„Wykorzystanie technik kooperacyjnych do poprawy dokładności wyznaczania położenia w ultraszerokopa-*

smowym systemie lokalizacyjnym" (Improving ultra-wideband positioning system accuracy through cooperative localization), Assist. Prof. **R. Michnowski** (supervisor). M.Sc. degree with honours.

[MSc15] Ewelina Krawczyk: *„Ocena włóknienia mięśnia sercowego na podstawie map czasu relaksacji podłużnej"* (Evaluation of myocardial fibrosis on the basis of longitudinal relaxation time maps), Assist. Prof. **B. Sawionek** (supervisor).

[MSc16] Wioleta Kruk: *„Współosiowe dzielniki/sumatory dużej mocy stosowane we wzmacniaczach mikrofalowych – parametry i ograniczenia"* (High power coaxial dividers/combiners for microwave amplifiers – parameters and limitations), Assoc. Prof. **W. Wojtasiak** (supervisor).

[MSc17] Krzysztof Krysiak: *"Badania wpływu rozwiązań poprawiających zasięg łączności na jakość obsługi w sieci komórkowej"* (Testing the influence of network coverage improving devices on service quality), Reader, **J. Cichocki** (supervisor).

[MSc18] Łukasz Kwiatkowski: *„Odbiór sygnału LTE z wykorzystaniem techniki radia programowalnego SDR"* (LTE signal decoding with the use of Software Defined Radio), Assist. Prof. **S. Kozłowski** (supervisor).

[MSc19] Aleksandra Latos: *„Program do wstępnej klasyfikacji i diagnostyki przebiegów EKG"* (Program for initial classification and diagnostics of ECG waveforms), Assist. Prof. **G. Domański** (supervisor).

[MSc20] Rafał Majewski: *"Badanie czynnościowe fMRI układu motorycznego: stymulator i oprogramowanie"* (Functional imaging of motor system: stimulator and software), Prof. **P. Bogorodzki** (supervisor).

[MSc21] Michał Andrzej Mańkowski: *„Hierarchiczna metoda indukcji reguł decyzyjnych"* (Hierarchical method of decision rules induction), Prof. **T. Łuba** (supervisor).

[MSc22] Bartosz Marcinkowski: *"Pasywny radar programowalny działający w oparciu o RTL-SDR"* (Software defined passive radar using RTL-SDR), Assoc. Prof. **J. Misiurewicz** (supervisor), studies in English.

[MSc23] Aleksandra Markowska: „Proces wytwarzania i pasywacji detektorów podczerwieni na bazie materiału InAs/GaSb" (Investigation of InAs/GaSb superlattice based detectors – device fabrication and surface passivation), Assist. Prof. **R. Szabatin** (supervisor).

[MSc24] Ewa Anna Mergalska: *„Pomiary funkcji przenoszenia głowy (HRTF)"* (Measurements of head-related transfer function (HRTF)), Prof. **J. Żera** (supervisor).

[MSc25] Marcin Miazga: *„Projekt anteny tubowej na pasmo subterahercowe przeznaczony do realizacji w technologii LTCC"* (Sub-THz horn antenna integrated in LTCC technology), Prof. **Y. Yashchyshyn** (supervisor).

[MSc26] Wojciech Minda: *„Bezdotykowy miernik napięcia lampy rentgenowskiej"* (Contactless measurer of X-ray tube), Prof. **J. Marzec** (supervisor).

[MSc27] Michał Mówiński: "Supresja kontralateralna emisji otoakustycznej wywołanej przez trzaski i krótkie tony" (The effect of contralateral suppression on optoacoustic emission evoked by clicks and tone bursts), Prof. **J. Żera** (supervisor).

[MSc28] Anna Niemyska: *"Wykorzystanie przewodnictwa kostnego w transmisji dźwięku"* (The use of bone conduction in sound transmission), Assist. Prof. **P. Bobiński** (supervisor).

[MSc29] Paweł Piotrowski: *„Analiza zagrożeń systemów dostępu warunkowego w telewizji cyfrowej"* (Analysis of weaknesses of conditional access systems used in digital television), Assist. Prof. **A. Buchowicz** (supervisor). M.Sc. degree with honours.

[MSc30] Rafał Protasiuk: *"Przetwarzanie i analiza obrazów w stereowizji podwodnej"* (Image processing and analysis in underwater stereovision), Prof. **W. Skarbek** (supervisor), M.Sc. degree with honours.

[MSc31] Kamil Skrzypczyk: *"Badanie efektywności metod zwiększania rozdzielczości obrazów medycznych"* (Evaluation the effectiveness of methods for improving resolution of medical images), Prof. **A. Przelaskowski** (supervisor), M.Sc. degree with honours.

[MSc32] Mateusz Słoboda: *„Analiza miar odległości w lokalizacji ruchomego terminala metodą mapy radiowej"* (Analysis of distance functions in fingerprinting based mobile positioning techniques), Assist. Prof. **P. Bajurko** (supervisor).

[MSc33] Tomasz Służewski: *"Opracowanie oraz badanie systemu bezprzewodowej łączności optycznej na diodach LED"* (Design and measurement of a LED-based wireless optical link), Prof. **Y. Yashchyshyn** (supervisor).

[MSc34] Jakub Jerzy Sobolewski: *"Analiza możliwości zastosowania technologii LTCC do wytwarzania anten na częstotliwości subterahercowe"* (Analysis of LTCC technology suitability for sub-terahertz antennas manufacturing), Assist. Prof. **P. Bajurko** (supervisor).

[MSc35] Magdalena Sołyga: *„Budowa i analiza funkcjonowania prototypu komorowej protezki strzemiączka"* (Construction and preliminaly experimental investigation of the first chamber stapes prosthesis prototype), Assoc. Prof. **M. Kwacz** (supervisor). M.Sc. degree with honours.

[MSc36] Łukasz Sypuła: *"Porównanie metod segmentacji obrazów mózgu wykorzystujących dane wzorcowe"* (Comparison of atlas-

-based segmentation methods of brain images), Assist. Prof. **R. Kurjata** (supervisor).

[MSc37] Artur Szostkowski: *"Konstrukcja modeli regresyjnych bazujących na algorytmach sztucznych sieci neuronowych i maszyn wektorów nośnych jako skuteczne narzędzie w ocenie jakości"* (Development of regression models based on artificial neural networks and support vector machines as an efficient tool for quality assessment), Prof. **A. Grzanka** (supervisor).

[MSc38] Przemysław Teodorski: *"Optymalizacja algebraicznych metod rekonstrukcji w tomografii komputerowej z wykorzystaniem algorytmów równoległych"* (The optimization of algebraic reconstruction techniques in computed tomography with parallel algorithms), Prof. **A. Przelaskowski** (supervisor).

[MSc39] Damian Mateusz Wanta: "Oprogramowanie sterujące układem akwizycji danych elektrycznego tomografu pojemnościowego EVT4" (Control software for data acquisition system of electrical capacitance tomograph EVT4), Assoc. Prof. **W. Smolik** (supervisor).

[MSc40] Wojciech Karol Węclewski: *"Spektrometryczny przetwornik A/C z interfejsem USB"* (A/D converter for spectrometry with USB interface), Prof. **J. Marzec** (supervisor).

[MSc41] Jakub Wilkowski: *"Opracowanie i badanie algorytmu lokalizacji użytkownika sieci LTE"* (Design and research of an algorithm for localization of a LTE network subscriber), Prof. **Y. Yashchyshyn** (supervisor).

[MSc42] Piotr Włodarczyk: *„Projekt anteny paskowej na pasmo sub-terahercowe przeznaczony do realizacji w technologii LTCC"* (Strip antenna design on sub-terahertz bandwith destined to construct in LTCC technology), Prof. **Y. Yashchyshyn** (supervisor), M.Sc. degree with honours.

[MSc43] Karolina Wodzyńska: "Mikroprocesorowe urządzenie do pomiaru utlenowania krwi ze złączem radiowym" (Microprocessor device for measurement of blood oxygenation with radio connection), Assist. Prof. **G. Domański** (supervisor).

[MSc44] Anna Wyszyńska: *„Identyfikacja białek w badaniach proteomicznych wykorzystujących tandemową spektrometrię mas"* (Identification of proteins in proteomics studies using tandem mass spectrometry), Assist. Prof. **T. Rubel** (supervisor).

[MSc45] Dawid Zdrojewski: *"Klasyfikacja schorzeń nowotworowych metodą wektorów nośnych na podstawie danych z mikromacierzy DNA"* (Tumor classification using Support Vector Machine and microarray data), Assist. Prof. **T. Rubel** (supervisor).

[MSc46] Natalia Maria Zienkowicz: *„Wykorzystanie kwaternionowej postaci wykładniczej w analizie obrazów RGB i HSV"* (Application of the quaternion exponential form in RGB and HSV image analysis), Assoc. Prof. **K. Snopek** (supervisor).

[MSc47] Szymon Zwolan: *„Tomografia rentgenowska z wykorzystaniem wiązki stożkowej i detektora powierzchniowego Varian PaxScan"* (Cone-beam X-ray computed tomography with Varian PaxScan flat-panel detector), Assoc. Prof. **W. Smolik** (supervisor).

[MSc48] Marek Żelechowski: *„System zdalnego monitoringu dla pacjentów obłożnie chorych"* (Remote monitoring system for bedridden patients), Assist. Prof. **B. Konarzewski** (supervisor).

[MSc49] Anna Żukowska: *„Segmentacja, analiza i wizualizacja krążków międzykręgowych"* (Segmentation, analysis and visualization of intervertebral discs), Assist. Prof. **E. Piątkowska-Janko** (supervisor). M.Sc. degree with honours.

5.4 M.Sc. Evening Studies on Radiocommunications – M.Sc. Degrees

[MSc50] Andrzej Kobiałka: *"Metoda informatycznego wsparcia portów lotniczych w zakresie nadzoru nad personelem lotniczym"* (Airports support method in the supervision of aviation personel), Assist. Prof. **K. Ignasiak** (supervisor).

5.5 B.Sc. Degrees

[BSc1] Bartłomiej Boruta: *"Inteligentny monitoring pomieszczenia z wykorzystaniem biblioteki OpenCV"* (Intelligent interior monitoring with OpenCV library), Assist. Prof. **J. Naruniec** (supervisor).

[BSc2] Cezary Borowy: *"Symulator elektrycznego tomografu pojemnościowego EVT4 w języku JAVA"* (Electrical capacitance tomograph EVT4 simulator), Senior Lecturer **T. Olszewski** (supervisor).

[BSc3] Maurycy Jan Brenner: *"Projekt anteny rożkowej pracującej w pasmie 340 GHz"* (A project of a horn antenna working in band 340 GHZ), Assist. Prof**. P. Kopyt** (supervisor).

[BSc4] Agata Julita Brodowska: *"Kontrola jakości gamma kamery półprzewodnikowej GE Discovery NM 530c"* (Quality control of semiconductor gamma camera GE Discovery NM 530c), Assist. Prof. **R. Szabatin** (supervisor).

[BSc5] Nikola Brodowska: *„System do badania poprawy lokalizacji i rozumienia mowy w hałasie u osób z jednostronną głuchotą, u których wszczepiono implant na przewodnictwo kostne"* (The study to improve the localization and speech understanding in noise in single side deafness patients with bone conduction implant), Assist. Prof. **G. Makarewicz** (supervisor).

[BSc6] Paweł Chojnowski: *"Mobilny system prezentacji treści multimedialnej"* (Mobile mul-

timedia content presentation system), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc7] Piotr Dłużewski: *„Model spektrometrycznego przetwornika A/C z przesuwną skalą”* (Model spectrometric A/D converter with a sliding scale method), Assist. Prof. **B. Konarzewski** (supervisor).

[BSc8] Hubert Fabisiak: *"Multimedialny kiosk informacyjny – moduł www aplikacji administracyjnej i informacyjnej”* (Multimedia information kiosk – web application), Assist. Prof. **A. Buchowicz** (supervisor).

[BSc9] Mateusz Filipek: *„Program do analizy obrazów dyfuzyjnych rezonansu magnetycznego”* (An applications for diffusion--weighted imaging results analysis), Prof. **P. Bogorodzki** (supervisor).

[BSc10] Anna Helena Gora: *“Ilościowa ocena rezerwy perfuzji mięśnia sercowego na podstawie danych obrazowych z tomografii rezonansu magnetycznego”* (Quantitative assessment of myocardial perfusion reserve on the basis of magnetic resonance imaging data), Assist. Prof. **B. Sawionek** (supervisor), B.Sc. degree with honours.

[BSc11] Gabriela Grońska: *„Akcelerometryczny detektor kaszlu - budowa oraz badanie sprawności płytki PCB”* (Accelerometric cough detector - structure and functionality research of the PCB), Prof. **T. Pałko** (supervisor).

[BSc12] Magdalena Grzesiak: *“Szpitalny system 'e-pager' z wykorzystaniem smartfonów i sieci Wi-Fi”* (A hospital e-pager system using smartphones and Wi-Fi), Assist. Prof. **R. Kurjata** (supervisor).

[BSc13] Weronika Jaczewska: *„Analiza numeryczna FDTD światłowodowych filtrów Bragga”* (FDTD numerical analysis of fiber Bragg gratings), Assoc. Prof. **B. Salski** (supervisor).

[BSc14] Magda Jaworowska: *“Układ nasobnego detektora zbliżeniowego i przeszkód wykorzystującego aktywne czujki ultradźwiękowe”* (The wearable obstacle detector based on ultrasonic sensor), Assist. Prof. **W. Rupniewski** (supervisor).

[BSc15] Justyn Jóźwiak: *“Platforma automatycznego przetwarzania danych neuroobrazowych XNAT”* (XNAT as a platform for automated processing of neuroimaging data), Prof. **P. Bogorodzki** (supervisor).

[BSc16] Arkadiusz Józwik: *„Układ rejestracji poboru prądu urządzeń sieci bezprzewodowych z zasilaniem bateryjnym” (*Current consumption measurement system for battery supplied wireless devices), Assist. Prof. **J. Kołakowski** (supervisor).

[BSc17] Krzysztof Kachniarz: *„Aplikacja mobilna do pomiaru podstawowych parametrów akustycznych pomieszczeń”* (Mobile application for making measurments of basic acoustic parameters of the room), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc18] Agata Karwowska: *„Oprogramowanie wspomagające badania sygnałów ultraszerokopasmowych za pomocą analizatora widma”* (Application supporting ultra wideband signal measurements), Reader **J. Cichocki** (supervisor).

[BSc19] Karol Klimkowski: “Implementacja algorytmów analizy czasowo-częstotliwościowej sygnałów audio w środowisku MATLAB” (Implementation of the algorithms for the time – frequency analysis of audio signals in MATLAB environment), Prof. **Z. Kulka** (supervisor).

[BSc20] Jakub Kolada: *„Mobilny przewodnik po Wydziale Elektroniki i Technik Informacyjnych Politechniki Warszawskiej”* (Mobile guide into The Faculty of Electronics And Information Technology), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc21] Kinga Kondracka: *“Badanie oddziaływania komórek naczyń krwionośnych na struktury ISFET”* (Study of influence of blood vessels cells on ISFET transistors), Assist. Prof. **P. Firek** (supervisor).

[BSc22] Krzysztof Konstantinov: *“Projekt i realizacja systemu auralizacji dźwięku przestrzennego na procesorze sygnałowym”* (Project and realization of system of auralization on digital sound procesor), Assist. Prof. **P. Bobiński** (supervisor).

[BSc23] Bartosz Kordaczuk: *„Narzędzie do pozyskiwania, analizy i oznaczania twarzy ze zbiorów internetowych”* (A tool for acquisition, analysis and determination of faces from the Internet), Assist. Prof. **J. Naruniec** (supervisor).

[BSc24] Kacper Kosikowski: “Projekt i realizacja oprogramowania do auralizacji dźwięku w pomieszczeniu zamkniętym” (Software for auralization of enclosed spaces – design and implementation), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc25] Jakub Andrzej Kosiorek: *„System redukcji argumentów i dekompozycji równoległej funkcji boolowskich”* (Argument reduction system and parallel decomposition of boolean functions), Prof. **T. Łuba** (supervisor), Warsaw University of Technology Distant Learning Center (Ośrodek Kształcenia na Odległość PW).

[BSc26] Joanna Kamila Kotynia: *“Monitor oddechu wykorzystujący promieniowanie podczerwone”* (Respiratory monitor using infrared radiation), Assist. Prof. **M. Rupniewski** (supervisor), B.Sc. degree with honours.

[BSc27] Piotr Kozłowski: *„Symulacja układu do pomiaru małych pojemności z idealnym integratorem”* (Computer simulation model of system to measure small capacitance with an ideal integrator), Senior Lecturer **T. Olszewski** (supervisor).

[BSc28] Kamil Kubik: *"Projekt i konstrukcja przedwzmacniacza gramofonowego"* (Design and construction of photo preamplifier), Assist. Prof. **G. Makarewicz** (supervisor).

[BSc29] Krzysztof Lech Kucharski: *"Biblioteka narzędzi wyznaczania i porównywania deskryptorów MPEG-7"* (Software library of extraction and comparison tools for MPEG--7 descriptors), Assist. Prof.**G. Galiński** (supervisor).

[BSc30] Filip Kulpa: *„Internetowy system udostępniania materiałów dydaktycznych"* (The online system for sharing teaching materials), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc31] Jakub Grzegorz Kurek: *"Oprogramowanie do przetwarzania wstępnego danych z tandemowej spektrometrii mas"* (Software for preprocessing tandem mass spectrometry data), Assist. Prof. **T. Rubel** (supervisor).

[BSc32] Natalia Kyc: *"Wykorzystanie lasera do cięcia podłoży krzemowych w zastosowa niach biomedycznych"* (Application of laser in cutting silicon base in biomedical use), Assist. Prof. **P. Firek** (supervisor).

[BSc33] Marcin Lembke: *"System zliczania ludzi oparty na kamerze RGB-D Microsoft Kinect"* (People counting system based on Microsoft Kinect RGB-D camera), Assist. Prof. **J. Naruniec** (supervisor).

[BSc34] Karol Lewandowski: "*Układ analogowy do odbioru sygnału optycznego w pulsometrze"* (Analog circuit for receiving the optical signal in pulsometer), Assist. Prof. **G. Domański** (supervisor).

[BSc35] Maria Teresa Listwon: *„Analiza pola temperatury w termografii twarzy ludzkiej"* (Analysis of temperature field in facial thermography), Assist. Prof. **Z. Wawrzyniak** (supervisor).

[BSc36] Partycja Maciocha: *„Projekt i realizacja multimedialnej strony www Zakładu Elektroakustyki"* (Design and implementation of Electroacoustics Division multimedia website), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc37] Józef Marek: *„System monitoringu oparty na algorytmach przetwarzania obrazu"* (The monitoring system based on image processing algorithms), Assist. Prof. **J. Naruniec** (supervisor).

[BSc38] Katarzyna Mazur: *„Automatyczna detekcja artefaktów w sygnałach biomedycznych"* (Automatic detection of artifacts in biomedical signals), Assist. Prof. **W. Rupniewski** (supervisor), B.Sc. degree with honours.

[BSc39] Marta Mikołajczyk: *„Smartfon jako urządzenie sterujące do komputerowego odtwarzacza multimediów"* (A smartphone as a controller for a computer media player), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc40] Kamil Piotr Mucha: *"Projekt i realizacja detektora energii dla telewizji cyfrowej"* (Design and implementation of energy detector for digital TV), Assist. Prof. **S. Kozłowski** (supervisor).

[BSc41] Eryk Najduchowski: "*Projekt i realizacja nagrania zestwu perkusyjnego, gitar elektrycznych oraz wokalu przy wykorzystaniu różnych technik mikrofonowych i miksowania"* (Project and realization of drum set, electric guitars and vocal recordings with the use of different microphone and mixing techniques), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc42] Katsiaryna Nedvetskaya: *„Identyfikacja osób na podstawie obrazów ust"* (Personal identification based on lips photographs), Assist. Prof. **J. Naruniec** (supervisor).

[BSc43] Marta Nowak: *„Opracowanie ultraszerokopasmowego układu transmisji danych z wykorzystaniem modułu DWM1000"* (Development of ultra wideband data transmission system based on DWM1000 modules), Assist. Prof. **J. Kołakowski** (supervisor).

[BSc44] Urszula Nowakowska: „*Optymalizacja procedur wygrzewania w piecach laboratoryjnych do anilacji detektorów termoluminescencyjnych"* (Optimization of thermal procedures in laboratory furnaces to anealing thermoluminiscent detectors), Assist. Prof. **P. Tulik** (supervisor).

[BSc45] Katarzyna Orzechowska: *„Mobilny system do elektronicznego przeprowadzania segregacji (triage) ofiar zdarzeń masowych"* (System for performing medical triage procedure using mobile device), Assist. Prof. **R. Kurjata** (supervisor), B.Sc. degree with honours.

[BSc46] Jan Otremba: *"Implementacja programów do bezprzewodowej komunikacji w sieciach sensorowych na bazie mikrokontrolera z rdzeniem ARM"* (Wireless communication for sensor networks based on ARM microcontroller), Assist. Prof. **A. Podgórski** (supervisor).

[BSc47] Adam Pacewicz: *„Symulator elektromagnetyczny do badania generacji supercontinuum w mikrostrukturalnych włóknach światłowodowych"* (An electromagnetic simulator for research on supercontinuum generation in microstructured optical fibers), Assoc. Prof. **B. Salski**, (supervisor), B.Sc. degree with honours.

[BSc48] Michał Konrad Pędzimąż: *"Projekt i realizacja konwencjonalnego fonicznego przetwornika analogowo-cyfrowego"* (Design and assembly of audio conventional analog-to-digital conversion system), Assist. Prof. **P. Bobiński** (supervisor).

[BSc49] Rafał Pilarczyk: *„System zdalnego załączania odbiornika energii elektrycznej z interfejsem Wi-Fi"* (Remote switch system of devices with Wi-Fi interface), Assist. Prof. **R. Łukaszewski** (supervisor).

[BSc50] Mateusz Rac: *„Implementacja algorytmu dopasowania obrazów planarnych”* (The implementation of image registration algorithm), Assist. Prof. **P. Tulik** (supervisor).

[BSc51] Marcin Rytel: *“Pracujący w paśmie UHF moduł łączności bezprzewodowej z bezzałogową platformą latającą (UAV)”* (UHF band data transceiver designed for wireless data link with an unmanned aerial vehicle (UAV)), Assist. Prof. **P. Kopyt** (supervisor).

[BSc52] Eryk Sajur: *„Narzędzie do testowania algorytmów do segmentacji obrazów MRI serca”* (Cardiac MRI images segmentation algorithms testing tool), Assist. Prof. **E. Piątkowska-Janko** (supervisor).

[BSc53] Monika Selegrat: *“Badania porównawcze zmienności wybranych kątów kręgosłupa w trakcie chodu do wyników uzyskanych na Politechnice Mediolańskiej”* (Comparative study of variability of spine angles during walking to the results obtained at Politecnico di Milano), Assist. Prof. **J. Dusza** (supervisor).

[BSc54] Andrzej Henryk Skwarecki: *„Badanie parametrów anten ceramicznych”* (The examination of ceramic antennas' parameters), Assist. Prof. **P. Bajurko** (supervisor).

[BSc55] Maurycy Sota: „Badanie właściwości akustycznych zespołu pomieszczeń studyjnych firmy „Start International Polska” (Acoustic measurements of the acoustic rooms of „Start International Polska”), Prof. **J. Żera**, (supervisor).

[BSc56] Krzysztof Szczypior: *“Program do symulacji detektora scyntykamery”* (Program for the simulation of the scinticamera detector), Assist. Prof. **G. Domański** (supervisor).

[BSc57] Paweł Wacław Szymański: *“Pomiar zniekształceń geometrycznych tomografu MRI”* (Measurement of geometric distortion in MRI scanner), Prof. **P. Bogorodzki** (supervisor).

[BSc58] Przemysław Szymański: *“Opracowanie projektu sieci komputerowej z uwzględnieniem bezpieczeństwa sieciowego”* (Design computer network for a company including network security), Assist. Prof. **P. Witoński** (supervisor), Warsaw University of Technology Distant Learning Center (Ośrodek Kształcenia na Odległość PW).

[BSc59] Bartłomiej Świderek: *„Programowalny zasilacz na magistralę VME do systemów pomiarowych dla elektroniki jądrowej”* (Programmable laboratory power supply to work with VME bus for measurement systems in nuclear electronics), Assist. Prof. **M. Dziewiecki** (supervisor).

[BSc60] Rafał Mateusz Trojak: *„Przyjazny urządzeniom mobilnym interetowy serwis informacji medycznej dla przychodni”* (Mobile friendly web information exchange service for medical clinics), Assist. Prof. **R. Kurjata** (supervisor).

[BSc61] Magdalena Uziębło: *“Mobilny system do kontroli zleceń lekowych w szpitalu”* (System for control of medication administration using mobile devices), Assist. Prof. **R. Kurjata** (supervisor).

[BSc62] Paweł Walasek: *“Automatyczny tor przetwarzania danych obrazowych do badań strukturalnych mózgu”* (Automated pipeline for structural brain images), Prof. **P. Bogorodzki** (supervisor).

[BSc63] Karolina Walędzik; “Budowa jednokanałowego wzmacniacza sygnału EEG” (The construction of a single-channel EEG), Assist. Prof. **G. Domański** (supervisor), B.Sc. degree in honours.

[BSc64] Marek Warpechowski: *“Klasyfikacja treści obrazów za pomocą statystyk opisowych”* (Image content classification using descriptive statistics), Prof. **A. Przelaskowski** (supervisor), Warsaw University of Technology Distant Learning Center (Ośrodek Kształcenia na Odległość PW).

[BSc65] Marlena Wawer: *“Projekt filtru na pasmo subterahertzowe przeznaczone do realizacji w technologi LTCC”* (Project of filter in frequency sub terahertz destined for implementation of LTCC technology), Assist. Prof. **K. Derzakowski** (supervisor).

[BSc66] Piotr Wawryniuk: “Wysokosprawny rezonansowy wzmacniacz klasy E” (Class E resonant amplifier), Assist. Prof. **M. Mikołajewski** (supervisor).

[BSc67] Paweł Wiśniewski: *“Manualna segmentacja obrazów MRI serca (Objective-C)”* (Manual segmentation of cardiac MRI pictures (objective-C)), Assist. Prof. **B. Sawionek** (supervisor).

[BSc68] Mateusz Włodarczyk: *“Urządzenie EMG do wykrywania intencji sterowania wózkiem inwalidzkim”* (EMG apparatus for detection of intent in wheelchair control), Prof. **A. Grzanka** (supervisor).

[BSc69] Katarzyna Woźna: *“Układ przedwzmacniacza do modułu ultraszerokopasmowej transmisji danych DW1000”* (An external preamplifier to the DW1000 module for ultra-wideband transmission), Assist. Prof. **R. Michnowski** (supervisor).

[BSc70] Simona Ewelina Wójcik: *„Opracowanie procedur testów kontroli jakości w tomografii PET w Affidea Mazowieckim Centrum PET/CT* (Formulating new guidelines for implementation of quality assurance and control programmes of PET tomography in Affidea Mazowieckie Centrum PET/CT), Assist. Prof. **R. Szabatin** (supervisor), B.Sc. degree with honours.

[BSc71] Katarzyna Wynimko: *“Projekt i realizacja mobilnej adaptacji akustycznej pomieszczenia wielofunkcyjnego”* (Project and realization of a room in the electroacoustics division's mobile acoustical adaptation), Assist. Prof. **P. Bobiński** (supervisor).

[BSc72] Marta Zackiewicz: *„Prosty tomograf impedancyjny z jednym torem pomiarowym"* (Simple impedance tomograph model with a single measuring track), Senior Lecturer **T. Olszewski** (supervisor).

[BSc73] Tomasz Zagubin: *"Pomiar długoczasowej stabilności tomografu MRI"* (Measurement of long-term stability of MRI scanner), Prof. **P. Bogorodzki** (supervisor).

[BSc74] Michał Zwierzyński: *"Liniowy szerokopasmowy wzmacniacz mocy na zakres fal krótkich do laboratorium studenckiego"* (Linear broadband amplifier for shortwave range at students' laboratory), Assist. Prof. **J. Modzelewski** (supervisor).

[BSc75] Mateusz Zubek: *"Internetowy serwis "wideo na żądanie"* (Video on demand website), Assist. Prof. **G. Galiński** (supervisor).

5.6 B.Sc. Evening Studies on Radiocommunications – B.Sc. Degrees

[BSc76] Mateusz Andruszuk: *"Rozbudowa sieci radiowej w sieci korporacyjnej"* (Wireless network development in a corporate network), Assist. Prof. **K. Kurek** (supervisor).

[BSc77] Włodzimierz Hepner: *"Odbiornik radiofoniczny sygnału fal UKF"* (The radiophonic receiver of VHF wave signal), Senior Lecturer **H. Chaciński** (supervisor).

[BSc78] Łukasz Karolkiewicz (co-author Michał Piechnik): *"Układ kontrolno-sterujący do nadajnika DRM"* (Command and control system for DRM transmitter), Assist. Prof. **W. Kazubski** (supervisor).

[BSc79] Michał Malanowski: *"Stacja pogodowa z bezprzewodowym odczytem danych"* (Weather station with wireless data reading), Senior Lecturer **H. Chaciński** (supervisor).

[BSc80] Paweł Obojski: *"Projekt i realizacja układów sterowania modelu samochodu"* (The design and implementation of control systems of a model car), Senior Lecturer **H. Chaciński** (supervisor).

[BSc81] Michał Piechnik (co-author Łukasz Karolkiewicz): *"Układ kontrolno sterujący do nadajnika DRM"* Command and control system for DRM transmitter), Assist. Prof. **W. Kazubski** (supervisor).

[BSc82] Karol Pięta: *"Odbiornik ADS-B na bazie tunera DVB-T"* (ADS-B receiver based on DVB-T), Assist. Prof. **W. Kazubski** (supervisor).

5. PUBLICATIONS

6.1. Scientific and technical books, chapters in books

[Pub1] S.L. Hahn, K. M. Snopek: “Complex and Hypercomplex Analytic Signals: Theory and Applications”, *Artech House* ISBN 978--1-63081-132-7 (2016), 316 pp.

[Pub2] A. Rychter: “Measurement Based Characterization and Modelling of Micropixel Avalanche Photodiodes”, *Editorial Series on Accelerator Science*, R. Romaniuk, M. Vretenar (Eds.), *Oficyna Wydawnicza PW*, ISBN 978-83-7814-605-6 (2016), 138 pp.

6.2. Scientific and technical papers in journals

6.2.1 Part A

This subsection contains the list of papers published in the journals indicated on the list A of the Ministry of Science and Higher Education, including those listed in the Thomson-Reuters Journal Citation Reports. Papers authored by more than 10 persons from outside of the Faculty of Electronics and Information Technologies, WUT, have been specifed in a simplified way, *viz.*: only the first author and all the authors from the Faculty have been listed and the number of others authors has been provided in brackets.

[Pub3] K. Abe (…), M. Dziewiecki, R. Kurjata, P. Płoński, A. Rychter, K. Zaremba, M. Ziembicki (352 external authors): „Upper Bound on Neutrino Mass based on T2K Neutrino Timing Measurements”, *Physical Review D*, vol. 93 (2016), doi: 10.1103/ PhysRevD.93.012006, pp. 012006-1-0120-06-15.

[Pub4] K. Abe (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (328 external authors): „Measurement of Muon Antineutrino Oscillations with an Accelerator-Produced Off-Axis Beam”, *Physical Review Letters,* vol. 116, issue 18 (2016), doi: http://dx.doi.org/10.1103/PhysRevLett.116. 181801, pp. 181801-1-181801-8.

[Pub5] K. Abe (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (448 external authors): „Measurement of the Muon Neutrino Inclusive Charged-Current Cross Section in the Energy Range of 1-3 GeV with the T2K INGRID Detector”, *Physical Review D*, vol. 93, issue 7 (2016), doi: 10.1103/PhysRevD.93.072002, pp. 072002-1-072002-23.

[Pub6] K. Abe (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (328 external authors): „Measurement of Double-Differential Muon Neutrino Charged-Current Interactions on C8H8 without Pions in the Final State Using the T2K Off-Axis Beam”, *Physical Review D*, vol. 93, issue 1 (2016), doi: 10.1103/PhysRevD.93.112012, pp. 112012-1-112012-9.

[Pub7] K. Abe (...), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (329 external authors): „Measurement of Coherent π^+ Production in Low Energy Neutrino-Carbon Scattering”, *Physical Review Letters,* vol. 117 (2016), pp. 192501-1--192501-7.

[Pub8] K. Abe (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (334 external authors): „Measurement of Muon Antineutrino Oscillations with an Accelerator-Produced Off-Axis Beam”, *Physical Review Letters,* vol. 116 (2016), pp. 181801--1-181801-8.

[Pub9] C. Adolph (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (208 external authors): „Longitudinal Double Spin Asymmetries in Single Hadron Quasi-Real Photoproduction at High p(T)”, *Physics Letters B*, vol. 753 (2016), doi: 10.1016/j.physletb.2015. -12.035, pp. 573-579.

[Pub10] C. Adolph (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (208 external authors): „The Spin Structure Function g(1)(p) of the Proton and a Test of the Bjorken Sum Rule”, *Physics Letters B*, vol. 753 (2016), doi: 10.1016/j.physletb.2015.12.064, pp. 18-28.

[Pub11] C. Adolph (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (208 external authors): „Interplay Among Transversity Induced Asymmetries in Hadron Leptoproduction”, *Physics Letters B*, vol. 753 (2016), pp. 406-411.

[Pub12] Ł. Błaszczyk: “Compressed Sensing in MRI – Mathematical Preliminaries and Basic Examples”, *Nukleonika – International Journal of Nuclear Research*, vol. 61, no. 1 (2016), doi: 10.1515/nuka-2016-0003, pp. 41-43.

[Pub13] Ł. Błaszczyk, K. M. Snopek: “Octonian Fourier Transform of Real-Valued Functions of Three Variables – Selected Properties and Examples”, *Signal Processing* (2016), http://dx.doi.org/10.1016/j.sigpro.-2016.11.021, 9 pp.

[Pub14] G. Bogdan, Y. Yashchyshyn, M. Jarzynka: “Time-Modulated Antenna Array with Lossless Switching Network”, *IEEE Antennas and Wireless Propagation Letters,* vol. 15, (2016), doi: 10.1109/LAWP.2016.2538463, pp. 1827-1830.

[Pub15] T. Ciuk, O. Petruk, A. Kowalik, I. Jóźwik, A. Rychter, J. Szmidt, W. Strupiński: „Low-Noise Epitaxial Graphene on SiC Hall Effect Element for Commercial Applications”, *Applied Physics Letters*, vol. 108, no. 223504 (2016), doi: 10.1063/1.49--53258, 6 pp., published online.

[Pub16] D. Coquillat, J. Marczewski, P. Kopyt, N. Dyakonova, B. Giffard, W. Knap: „Improvement of Terahertz Field Effect Transistor Detectors by Substrate Thinning and Radiation Losses Reduction", *Optics Express*, vol. 24, no. 1 (2016), doi: 10.1364/OE.24.000272, pp. 272-281.

[Pub17] G. Domański, B. Konarzewski, R. Kurjata, J. Marzec, K. Zaremba, M. Dziewiecki, M. Ziembicki, A. Rychter: „The Study of Radiation Damage of EPROM 2764 Memory", *Nuclear Technology & Radiation Protection,* vol. 31, no. 3 (2016), doi: 10.2298/NTRP 1603233D, pp. 233-239.

[Pub18] K. Janeczek, A. Araźna, B. Salski, K. Lipiec, M. Jakubowska: „Printed HF Antennas for RFID on-Metal Transponders", *Circuit World*, vol. 42, issue. 1 (2016), http://dx.doi.org/10.1108/CW-10-2015-00 -46, pp. 2-8.

[Pub19] T. Karpisz, B. Salski, R. Buczyński, P. Kopyt, A. Pacewicz: „Computationally--Efficient FDTD Modeling of Supercontinuum Generation in Photonic Crystal Fibers", *Optical and Quantum Electronics*, vol. 48, no. 175 (2016), doi: 10.1007/s11082-016--0428-y, published online, 11 pp.

[Pub20] P. Kopyt, B. Salski, M. Olszewska-Placha, D. Janczak, M. Słoma, T. Kurkus, M. Jakubowska, W. Gwarek: „Graphene-based Dipole Antenna for a UHF RFID Tag", *IEEE Transactions on Antennas and Propagation*, vol. 64, no. 7 (2016), published online, 7 pp.

[Pub21] P. Kopyt, B. Salski, P. Zagrajek, D. Janczak, M. Słoma, M. Jakubowska, M. Olszewska-Placha, W. Gwarek: „Electric Properties of Graphene-Based Conductive Layers from DC Up to Terahertz Range", *IEEE Transactions on Terahertz Science and Technology*, vol. 6, no. 3 (2016), pp. 480-490.

[Pub22] M. Kotliński, K. Rutowicz, Ł. Kniżewski, A. Palusiński, J. Olędzki, A. Fogtman, T. Rubel, M. Kobłowska, M. Dadlez, K. Ginalski, A. Jerzmanowski: „Histone H1 Variants in Arabidopsis are Subject to Numerous Post-Translational Modifications, Both Conserved and Previously Unknow in Histones, Suggesting Complex Functions of H1 in Plants", *Plos One*, vol. 11, issue 1, (2016), doi: 10.1371/journal.pone.0147908, pp. 1-19.

[Pub23] M. Kowalski, J. Naruniec: "Face Alignment Using K-Cluster Regression Forests with Weighted Splitting", *IEEE Signal Processing Letters*, vol. 23, no. 11 (2016), pp. 1567-1571.

[Pub24] S. Kozłowski: "Implementation and Verification of Cyclostationary Feature Detector for DVB-T Signals", *IET Signal Processing*, vol. 10, no. 2 (2016), doi: 10.1049/iet--spr.2014.0509, pp. 162-167.

[Pub25] J. Krupka, M. Zając, R. Kucharski, D. Gryglewski: „Delectric Properties of Highly Resistive GaN Crystals Grown by Ammonothermal Method at Microwave Frequencies", *AIP Advances*, vol. 6 (2016), doi: 10.1063/1.4944750, pp. 035313-1--035313-6.

[Pub26] J. Krupka, B. Salski, P. Kopyt, W. Gwarek: „Electrodynamic Study of YIG Filters and Resonators", *Scientific Reports - Nature*, vol. 6 (2016), doi: 10.1038/srep34739, 9 pp.

[Pub27] R. Z. Morawski, A. Miękina: "Application of Principal Components Analysis and Signal--to-Noise Ratio for Calibration of Spectrophotometric Analysers of Food", *Measurement*, vol. 79 (2016), http://dx.doi.--org/10.1016/j.measurement.2015.10.026, pp. 302-310.

[Pub28] P. Mazurek, A. Miękina, R. Z. Morawski: „Comparative Study of Three Algorithms for Estimation of Echo Parameters in UWB Radar Module for Monitoring of Human Movements", *Measurement,* vol. 88 (2016), http://dx.doi.org/10.1016/j.measurement.20 -16.03.025, pp. 45-57.

[Pub29] J. Naruniec, M. Wieczorek, S. Szufik, D. Koziorowski, M. Tomaszewski, M. Kowalski, A. Przybyszewski: „Webcam Based System for Video Occulography", *IET Computer Vision* (2016), doi: 10.1049/iet--cvi.2016.0226, 16 pp.

[Pub30] G. Pastuszak, A. Abramowski: "Algorithm and Architecture Design of the H.265/HEVC Intra Encoder", *IEEE Transactions on Circuits and Systems for Video Technology,* vol. 26, no. 1 (2016), doi: 10.1109/TCSVT.2015.2428571, pp. 210--222.

[Pub31] G. Pastuszak, M. Jakubowski: "Optimization of the Adaptive Computationally--Scalable Motion Estimation and Compensation for the Hardware H.264/AVC Encoder", *Journal of Signal Processing Systems,* vol. 82 (2016), doi: 10.1007/s11265--015-1021-5, pp. 391-402.

[Pub32] G. Pastuszak, M. Trochimiuk: "Architecture Design of the High-Throughput Compensator and Interpolator for the H.265/HEVC Encoder", *Journal of Real-Time Image Processing*, vol. 11 (2016), doi: 10.1007/ s1554-014-0422-1, pp. 663-673.

[Pub33] G. Pastuszak, M. Trochimiuk: "Algorithm and Architecture Design of the Motion Estimation for the H.265/HEVC 4K-UHD Encoder", *Journal of Real-Time Image Processing*, vol. 12, issue 2 (2016), doi: 10.1007/s11554-015-0516-4, pp. 517-529.

[Pub34] P. Prystawko, M. Sarzyński, A. Nowakowska-Siwińska, D. Crippa, P. Kruszewski, W. Wojtasiak, M. Leszczyński: „AlGaN HEMTs on Patterned Resistive/Conductive SiC Templates", *Journal of Crystal Growth*,

(2016), vol. 64, no. 7, available online, 5 pp.

[Pub35] D. Radomski: "Reprint of A Nonlinear Parametrization of Multivariate Electrohysterographical Signals", *Computers in Biology and Medicine*, vol. 69 (2016), pp. 254-260.

[Pub36] B. Salski, W. Gwarek, P. Kopyt, P. Theodorakeas, I. Hatziioannidis, M. Koui, A. Y. B. Chong, S. M. Tan, V. Kappatos, C. Selcuk, T-H. Gan: "Portable Automated Radio-Frequency Scanner for Non--Destructive Testing of Carbon-Fibre--Reinforced Polymer Composites", *Journal of Nondestructive Evaluation* vol. 35, no. 25, issue 2 (2016), doi: 10.1007/s-10921-016-0343-y, published online.

[Pub37] J. Skarzyński, M. Darmetko, S. Kozłowski, K. Kurek: „SDR Implementation of the Receiver of Adaptive Communication System", *Radio Science*, vol. 51 (2016), doi: 101002/2015RS005899, pp. 344-351.

[Pub38] G. Stępniewski, I. Kujawa, M. Klimczak, T. Martynkien, R. Kasztelanic, K. Borzycki, D. Pysz, A. Waddie, B. Salski, R. Stępień, M. R. Taghizadeh, R. Buczyński: „Artificially Anisotropic Core Fiber with Ultra-Flat High Birefringence Profile", *Optical Materials Express*, vol. 6, no. 5 (2016), pp. 1464-1479.

[Pub39] K. Werys, J. Petryka-Mazurkiewicz, Ł. Błaszczyk, J. Miśko, M. Śpiewak, Ł. A. Małek, Ł. Mazurkiewicz, B. Miłosz-Wieczorek, M. Marczak, A. Kubik, A. Dąbrowska, E. Piątkowska-Janko, B. Sawionek, R. Wijesurendra, S. K. Piechnik, P. Bogorodzki: „Cine Dyscontractility Index: A Novel Marker of Mechanical Dyssynchrony that Predicts Response to Cardiac Resynchronization Therapy", *Journal of Magnetic Resonance Imaging* (2016), doi: 10.1002/jmri.25295, pp. 1-10.

6.2.2. Part B

This subsection contains the list B of papers published in the journals indicated on the list B of the Ministry of Science and Higher Education.

[Pub40] P. Bilski: „Nieinwazyjna identyfikacja odbiorników energii elektrycznej z wykorzystaniem sztucznej inteligencji" (Non-Invasive Identification of Electrical Appliances Using Artificial Intelligence Methods), *Przegląd Elektrotechniczny*, vol. 92, no. 11 (2016), doi: 10.15199/48.2016.11 47, pp. 191-194.

[Pub41] G. Bogdan: „Szerokopasmowy szyk antenowy z polaryzacją kołową" (Wideband Planar Antenna Array with Circular Polarization), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), doi: 10.15199/ 59.2016.6.22, pp. 265-268.

[Pub42] A. Buchowicz: „Prezentacja sekwencji wizyjnych w przeglądarkach internetowych" (Video Playback in Web Browsers), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), pp. 572-575.

[Pub43] V. Djaja-Jośko, J. Kołakowski: „Metoda bezprzewodowej synchronizacji węzłów i korekcji wyników pomiarów TDOA w ultraszerokopasmowym systemie lokalizacyjnym" (A Method for Wireless Anchors Synchronization and Correction of TDOAS in the UWB Localization System), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), pp. 213-216.

[Pub44] J. Kołakowski, V. Djaja-Jośko, R. Michnowski, J. Cichocki: „Ultraszerokopasmowy podsystem lokalizacyjny w systemie nawigacyjnym EIGER" (Ultra-Wideband Localization Subsystem in EIGER Navigation System), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), pp. 225-228.

[Pub45] M. Kołakowski, R. Michnowski: „Wykorzystanie technk kooperacyjnych do poprawy dokładności i precyzji lokalizacji w ultraszerokopasmowym systemie lokalizacyjnym" (Improving Ultra-Wideband Positioning System Accuracy through Cooperative Localization), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), pp. 217-220.

[Pub46] T. Kosiło, K. Radecki: "Lokalizacja w pomieszczeniach, zastosowanie standardu Bluetooth Smart" (Indoor Localization Using Bluetooth Smart), *Elektronika - Konstrukcje - Technologie - Zastosowania*, no. 3 (2016), doi: 10.15199/13.2016.3.3, pp. 12-15.

[Pub47] E. Kotarbińska, K. Rogowski: „Czynniki zmniejszające skuteczność działania wkładek przeciwhałasowych stosowanych przez pracowników – wyniki badań" (Factors Reduce the Effectiveness of Earplugs Used by Employees - Test Results), *Bezpieczeństwo Pracy – Nauka i Praktyka*, vol. 536, no. 5 (2016), pp. 32-35.

[Pub48] G. Makarewicz: „Wykorzystanie specjalistycznych aplikacji działających w przeglądarkach internetowych do wspomagania oceny narażenia na hałas i drgania mechaniczne" (The Use of Mobile Devices as Tools to Support the Assessment of Exposure to Noise and Vibration), *Bezpieczeństwo Pracy – Nauka i Praktyka*, vol. 536, no. 5 (2016), pp. 36-39.

[Pub49] M. Mikołajewski: Wzmacniacz klasy E na zakres CB" (A Class E Amplifier for CB Band), *Przegląd Elektrotechniczny,* vol. 92, no. 9 (2016), doi: 10.15199/48.2016.09.04, pp. 16-18.

[Pub50] J. Modzelewski: „Analiza asymetrii w sterowaniu tranzystorów przeciwsobnego wzmacniacza mocy w.cz. za pomocą transformatora z linią transmisyjną", (Asymmetry Analysis of Transistors Driving by the Transmission-Line Transformer in H.F. Push-pull Power Amplifier), *Przegląd Elek-*

trotechniczny, vol. 92, no. 9 (2016), doi: 10.15199/48.2016.09.12, pp

[Pub51] M. Nowak, J. Kołakowski: „Badania wpływu sygnałów zakłócających na jakość odbioru w ultraszerokopasmowych sieciach IEEE.802.15.4A" (Investigation of Interfering Signals Impact on the Quality of Recetion in UWB IEEE 802.15.4A Networks), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), pp. 425-428.

[Pub52] P. Piasecki: „Pomiar charakterystyki anteny dookólnej z zastosowaniem oknowania w dziedzinie czasu" (Measurement of an Omnidirectional Antenna Radiation Pattern with Using a Time Domain Techniqe), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), doi: 10.15199/59.2016.6.23, pp. 269-272.

[Pub53] P. Piotrowski: „Analiza zagrożeń systemów dostępu warunkowego w telewizji cyfrowej" (Analysis of Weakeness of Conditional Access Systems Used in Digital Television), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), pp. 309-312.

[Pub54] A. Platonov, I. Zaitsev, H. Chaciński, L. Opalski, B. Jeleński, J. Piekarski: „Projektowanie i dostrajanie hardwarowego prototypu AFCS" (Design and Tuning of Hardware Implementaton of Analog Feedback Communication System), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), pp. 506-509.

[Pub55] A. Podgórski: „Accredited Calibration Laboratory for Sound Measurements", *Measurement Automation Monitoring* no. 8 (2016), doi: 10.1000/182, pp. 250-253.

[Pub56] B. Połok, P. Bilski: "A Low Cost Depth Sensor-Based Computer Control System for the Disabled People", *Measurement Automation Monitoring*, no. 9, vol. 62, pp. 292-296.

[Pub57] K. Radecki, T. Kosiło, M. Kołakowski, J. Marski: „Dynamiczna lokalizacja osób wewnątrz budynku z Beaconami Blotooth Eddystone" (Dynamic Indoor Localization of Persons Using Blotooth Eddystone Beacons), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), pp. 369-372.

[Pub58] W. Skarbek, J. Napieralska, J. Modelski: „Koncepcja interdyscyplinarnego programu nauczania multimediów na poziomie magisterskim – projekt norweski" (Syllabus Concept for Interdisciplinary Master Degree on Multimedia – the Norwegian Project), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), doi: 10.15199/59.2016.6.2, pp. 179-182.

[Pub59] J. Sobolewski, P. R. Bajurko: "Promiennik łatkowy na podłożu LTCC na pasmo 120 GHz" (A 120 GHz Patch Radiator on LTCC Substrate), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVIII, no. 6 (2016), doi: 10.15199/-59.2016.6.24, pp. 273-276.

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6.4. Textbooks

This subsection contains the list of publications developed in the frame of the project "International Master's Degree in multimedia – technology, design, management", within Development of Polish Universities Measure of Scholarship and Training Fund, supported by a grant from Iceland, Liechtenstein and Norway through the EEA and Norway Grants and co-financed by the Polish funds

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[Pub194] G. Galiński: "Color Temperature", in: W. Skarbek (Ed.), *Multimedia Techniques - Applications, Institute of Radioelectronics and Multimedia Technology*, *WUT*, ISBN 978-83-910040-6-7 (2016), available online: http://www.ire.pw.edu.pl/~mmed-ia/pub/Multimedia%20Techniques%20% - 20Applications/index.html, pp. 53-66.

[Pub195] G. Galiński: "Motion Activity Descriptors", in: W. Skarbek (Ed.), *Foundations of Multimedia Techniques Institute of Radioelectronics and Multimedia Technology*, *WUT*, ISBN 978-83-910040-6-7 (2016), available online: http://www.ire.pw.edu.pl/~mmedia/pub/Foundations%20%20Multimedia% 20Techniques/index.html, pp. 131-134.

[Pub196] G. Galiński, W. Skarbek: "Digital Media Descriptors", in: *„Multimedia Techniques - Applications",* W. Skarbek (Ed.), *Institute of Radioelectronics and Multimedia Technology*, *WUT*, ISBN 978-83-910040-6-7 (2016), available online: http://www.ire.-pw.edu.pl/~mmedia/pub/Multimedia%20Techniques%20%20Applications/index.html, pp. 89-130.

[Pub197] T. Kosiło: "Telecommunications for Multimedia", *Institute of Radioelectronics and Multimedia Technology*, *WUT*, ISBN 978-83-910040-7-4 (2016), available online: http://www.ire.pw.edu.pl/~mmedia/pub/Telecommunications%20for%20Multimedia/-index.html, 91 pp.

[Pub198] W. Skarbek: "Stochastic Models for Visual Tracking", in: W. Skarbek (Ed.), *Founda--tions of Multimedia Techniques, Institute of Radioelectronics and Multimedia Techno--logy*, *WUT*, ISBN 978-83-910040-5-0 (2016), available online: http://www.ire.-pw.edu.pl/~mmedia/pub/Foundations%20-%20Multimedia%20Techniques/index.html, pp. 5-20.

[Pub199] W. Skarbek: "Transformations Theory and Optimization. Problem Oriented Approach", in: W. Skarbek (Ed.), *Foundations of Mul--timedia Techniques, Institute of Radioele--ctronics and Multimedia Technology*, *WUT*, ISBN 978-83-910040-5-0 (2016), available online: http://www.ire.pw.edu.-pl/~mmedia/pub/Foundations%20%20Multimedia%20Techniques/index.html, pp. 21--42.

[Pub200] W. Skarbek: "Image and Sound Programming for Web", in: W. Skarbek (Ed.), *Foundations of Multimedia Techniques, Institute of Radioelectronics and Multimedia Tech--nology*, *WUT*, ISBN 978-83-910040-5-0 (2016), pp. 57-58, available online: http://-www.ire.pw.edu.pl/~mmedia/pub/Foundations%20of%20Multimedia%20Techniques/index.html.

[Pub201] W. Skarbek, G. Galiński: "Digital Media Indexing", in W. Skarbek (Ed.), *Multimedia Techniques - Applications, Institute of Radioelectronics and Multimedia Technology*, *WUT*, ISBN 978-83-910040-6-7 (2016), available online http://www.ire.-pw.edu.pl/~mmedia/pub/Mutimedia%20Techniques%20%20Applications/index.-html, pp. 73-88.

[Pub202] W. Skarbek, G. Galiński: "Digital Media Search", in W. Skarbek (Ed.), *MultimediaTechniques - Applications, Institute of Radioelectronics and Multimedia Technology*, *WUT*, ISBN 978-83-910040-6-7 (2016), available online http://www.ire.pw.edu.pl/-~mmedia/pub/Multimedia%20Techniques%20-%20Applications/index.html, pp. 67-72.

[Pub203] W. Skarbek, K. Ignasiak: "Basic Tools for Digital Media Programming in Python", in: W. Skarbek (Ed.), *Foundations of Multimedia Techniques, Institute of Radioelectro--nics and Multimedia Technology*, *WUT*, ISBN 978-83-910040-5-0 (2016), available online: http://www.ire.pw.edu.pl/~mmedia-/pub/Foundations%20%%20Techniques/index.html, pp. 43-56.

[Pub204] J. Żera: "Basics of Physical Acoustics", in: J. Żera (Ed.), *Acoustics and Audio Technology: a Tutorial for Multimedia, Institute of Radioelectronics and Multimedia Technology*, *WUT*, ISBN 978-83-910040-6-7 (2016), available online: http://www.ire.-pw.edu.pl/~mmedia/pub/Acoustics%20% -20Audio%20Technology/index.html, pp. 7--40.

6.5. Abstracts and Posters

[Pub205] S. L. Hahn: "Proposals for Experimental Verification of the Origin of the Cosmological Red-Shift", *Proc. International Conference on Astrophysics and Particle Physics* (Dallas, USA, Dec. 8-10, 2016), 1 p

[Pub206] E. Piątkowska-Janko, P. Bogorodzki: „Fantomy do kontroli jakości w MR (zalecenia AAPM, IPEM, ACR oraz fantomy dedykowane)" (Phantoms for Quality Controlin the MR (AAPM, IPEM, ACR Recommendations and Dedicated Phantoms), *Mat. 41 Zjazdu Polskiego Lekarskiego Towarzystwa Radiologicznego* (Proc. 41st Congress of the Polish Medical Society of Radiology) (Kraków, Poland, Jun. 2-4, 2016), 1 p.

[Pub207] M. Świątkiewicz, M. Fiedorowicz, J. Orzeł, P. Bogorodzki, J. Langfort, P. Grieb: „Spektroskopia protonowa uwidacznia zmiany metaboliczne w mózgu powodowane wysiłkiem fizycznym" (Proton Magnetic Resonanse Spectroscopy Reveals Exercise-Inducted Metabolic Changes in the Brain), *Mat. 41 Zjazdu Polskiego Lekarskiego Towarzystwa Radiologicznego* (Proc. 41st Congress of the Polish Medical Society of Radiology) (Kraków, Poland, Jun. 2-4, 2016), 1 p.

6.6. Books and special issues edited by the staff in the frame of the Project "International Master's Degree in Multimedia – Technology, Design, Management", within Development of Polish Universities Measure of Scholarship and Training Fund

W. Skarbek (Ed.): *Multimedia Techniques - Applications, Institute of Radioelectronics and Multimedia Technology*, *WUT*: [Pub189], [Pub190], [Pub191], [Pub192], [Pub193], [Pub195], [Pub200], [Pub201]; ISBN 978-83-910040-6-7.

W. Skarbek (Ed.): *Foundations of Multimedia Techniques, Institute of Radioelectronics and Multimedia Technology*, *WUT:* [Pub194], [Pub197], [Pub199], [Pub202]; ISBN 978-83-910040-5-0.

J. Żera (Ed.): *Acoustics and Audio Technology*: *a Tutorial for Multimedia, Institute of Radioelectronics and Multimedia Technology*, *WUT:* [Pub184], [Pub185], [Pub186], [Pub187], [Pub188], [Pub203]; ISBN 978--83-910040-4-3.

7. RESEARCH REPORTS

[Rep1] K. Abe (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (285 external authors): „Hyper-Kamiokande Design Report", Technical report, KEK preprint 2016-21, ICRR--Report-70102016-1, KEK, Japan, Feb. 2016.

[Rep2] P. Bogorodzki, E. Piątkowska-Janko, B. Kossowski, J. Orzeł: *„Opracowanie urządzenia działającego w polu magnetycznym skanera 3T, służącego do podawania niewielkich ilości płynnych substancji wraz z opracowaniem schematu dedykowanych badań czynnościowych"* (Development of Device Operating in a Magnetic Field of 3T Scanner for Delivering Small Quantities of Liquid Substances with the Dedicated Functional Studies), Final report for the Nencki Institute of Experimental Biology, WUT, Warsaw, Jan. 2016.

[Rep3] G. Domański: *„Uniwersalny system akwizycji sygnałów bioelektrycznych"* (Universal System for Bioelectric Signals Acquisition), Final report for the Rector grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Dec. 2016.

[Rep4] W. Gwarek, S. Rosłoniec, B. Salski, W. Wojtasiak, M. Celuch, D. Rosołowski, D. Gryglewski, P. Kopyt, P. Korpas, P. Miazga, M. Sypniewski, M. Krysicki, M. Góralczyk, D. Kuchta, T. Karpisz, M. Lubiejewski: *„Prace nad nowymi generatorami mikrofalowymi przeznaczonymi do przemysłowych urządzeń dużej mocy oraz nadajników systemów radiowych. Metody analizy elektromagnetycznej z uwzględnieniem efektów dyspersyjnych i nieliniowych*" (Work on New Microwave Generators for Industrial Applications and Radio Transmitters. Electromagnetic Analysis Including Modeling of Nonlinear and Dispersive Effects), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2016.

[Rep5] K. Ignasiak, W. Skarbek, G. Pastuszak, A. Buchowicz, G. Galiński, J. Naruniec, A. Abramowski, G. Brzuchalski, M. Roszkowski, M. Wieczorek, M. Trochimiuk, G. Gwardys, D. Grzywczak: *„Inteligentne, sieciowe systemy wideo"* (Audiovisual Networked Hybrid Systems), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology , WUT, Warsaw, Nov. 2016.

[Rep6] J. Kołakowski, J. Cichocki, R. Michnowski, K. Radecki, S. Żmudzin, V. Djaja-Jośko: *„Techniki przetwarzania sygnałów w odbiornikach ultraszerokopasmowych"* (Techniques for Signals Processing in UWB Receivers), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2016.

[Rep7] J. Kołakowski, J. Cichocki, R. Michnowski: *„Rozproszony system do pomiaru temperatury tężejącego betonu"* (Distributed System for Concrete Curing temperaturę measurement), Final report for MOSTOSTAL Warsaw, Dec. 2016.

[Rep8] P. Kopyt: *„Zaprojektowanie wąskopasmowych anten zintegrowanych z tranzystorami typu HEMT, pracujących w paśmie sub-THz"* (Design the Narrow-Band Antennas Integrated to HEMT Transistors at Sub-THz Band), Final report for the HFT Opto Ltd., Warsaw, Jun. 2016.

[Rep9] K. Kurek: *"Badanie zmian poziomu zanieczyszczeń atmosfery w funkcji wysokości z wykorzystaniem balonu stratosferycznego"* (Survey of Air Pollution Changes as a Function of Height Using Stratospheric Balloon), Final report for the Rector grant, Institute of Radioelectronics and Multimedia Techno- logy, WUT, Warsaw, Dec. 2016

[Rep10] M. Lewandowski: *„Laboratoryjne stanowisko do pomiarów, rejestracji i analizy dźwięku"* (Laboratory System for Measuring, Recording and Analyzing Audio Signals in Real Time), Final report for the Dean grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Dec. 2016.

[Rep11] J. Modelski, K. Kurek, J. Jarkowski (em.), T. Keller: *„Systemy radiokomunikacyjne w inteligentnym transporcie"* (Radiocommunication Systems in Intelligent Transport), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2016.

[Rep12] J. Modzelewski, H. Chaciński, W. Kazubski, M. Mikołajewski: *„Doskonalenie wyjściowych obwodów rezonansowych do quasi-szerokopasmowych i kluczowanych wzmacniaczy mocy"* (Improvement of Output Resonant Circuits for Conventional and Switch-Mode Semi-Wideband Power Amplifiers), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2016.

[Rep13] R. Z. Morawski, A. Miękina, A. Podgórski, P. Mazurek, J. Wagner: *„Metrologiczne i meta-metrologiczne aspekty interpretacji danych eksperymentalnych"* (Metrological and Meta-Metrological Aspects of Experimental data Interpretation), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2016.

[Rep14] B. Salski: *"Szerokopasmowy system pomiaru i akwizycji danych do badań nieniszczących materiałów kompozytowych"* (Wideband System for Measuring and Acquisition of Non-Destructive Testing of Conductive Composite Materials), Final report for the Rector grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Dec. 2016.

[Rep15] B. Salski, P. Kopyt: *„Ekspertyza dotycząca wartości natężenia pola elektromagnetycznego występującego w pobliżu instalacji typu mobilnego NEMP"* (Expertise on Electromagnetic Field Level Near NEMP Mobile Installation), Final report for the Military Communication Works no. 1, Joint Stock Company, Warsaw, Nov. 2016.

[Rep16] K. Snopek, T. Kosiło, S. Kozłowski, Ł. Błaszczyk: *„Wybrane zagadnienia teoretyczne i optymalizacja algorytmów przetwarzania sygnałów w systemach radiokomunikacyjnych"* (Chosen Theoretical Problems and Optimization of Signal Processing Algorithms in Radiocommunication Systems), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2016.

[Rep17] W. Wojtasiak, D. Gryglewski: *"Wykonanie elementów RNK"* (RNK Elements Construction), Final report for the Military Electronics Works, Joint Stock Company, Warsaw, Nov. 2016.

[Rep18] Y. Yashchyshyn, K. Godziszewski, A. Łysiuk, A. Skrzypkowski: *„Opracowanie oraz wykonanie modułów do transmisji radiowo-światłowodowej"* (Designing and Construction of Modules for Radio-Fiber Transmission), Final report for SIRC Ltd., Warsaw, Jun. 2016.

[Rep19] Y. Yashchyshyn, P. Bajurko, K. Derzakowski, K. Godziszewski, G. Bogdan, P. Piasecki: *"Badanie anten i materiałów w zakresie subterahercowym"* (Investigation of Antennas and Materials in Sub-Terahertz Range), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2016

[Rep20] K. Zaremba, P. Bogorodzki, P. Brzeski, G. Domański, M. Dziewiecki, T. Jamrógiewicz, B. Konarzewski, R. Kurjata, J. Marzec, T. Olszewski, E. Piątkowska-Janko, D. Radomski, B. Sawionek, W. Smolik, R. Szabatin, M. Ziembicki, W. Gradkowski, B. Kossowski, J. Kryszyn, W. Obrębski, J. Orzeł. A. Rychter, K. Werys, P. Wróblewski: *„Nowoczesne techniki elektroniki jądrowej i medycznej" (*Modern Techniques in Nuclear and Medical Electronics)*,* Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2016.

[Rep21] J. Żera, Z. Kulka, P. Bobiński, M. Lewandowski, G. Makarewicz: *„Nowe metody badania jakości przetwarzania dźwięku"* (New Methods for Testing Quality of Sound Processing), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Dec. 2016.

8. PATENTS AND PATENT APPLICATIONS

[Pat1] G. Bogdan, Y. Yashchyshyn: *"Sposób kształtowania charakterystyki kierunkowej w szyku antenowym z modulacją czasową oraz szyk antenowy z modulacją czasową"* (Methods of beamforming in the time--modulated antenna and design of the time-modulated antenna array) Patent application no. P-416239, Feb. 23, 2016.

[Pat2] P. Kopyt: *"Detektor promieniowania elektromagnetycznego o podniesionej czułości"* (Electromagnetic radiation detector with increased sensivity), Patent no. PL409222--A1, Feb. 23, 2016.

[Pat3] R. Kowalik, W. Winiecki, M. Januszewski, Ł. Nogal, R. Łukaszewski, P. Bilski, P. Bobiński: *„Sposób i urządzenie do identyfikacji odbiorników energii elektrycznej"* (A method and apparatus for electrical energy receivers identification), Patent application no. P-417462, Jun. 07, 2016.

[Pat4] S. Kozłowski: *„Sposób odbioru sygnału MIMO z multipleksacją przestrzenną za pomocą szyków antenowych"* (Method of signal reception in the MIMO system with spatial multiplexing using antenna arrays), Patent no. 224729, Jul. 13, 2016.

[Pat5] W. Smolik, R. Szabatin, B. Radzik, T. Olszewski, P. Brzeski: *„Układ ładuj--rozładuj do pomiaru małych pojemności"* (Charge-discharge system for small capacity measurement), Patent no. 404230, Sept. 05, 2016.

[Pat6] A. Strupczewski, J. Naruniec, K. Mucha, B. Czupryński: "*Method of tracking eye gaze, involves acquiring poit based on three-dimensionally modeled facial feature and detected iris center*", Patent, no. US2016026246-A1, USA Jan. 28, 2016.

[Pat7] W. Winiecki, R. Kowalik, R. Łukaszewski, P. Bilski, M. Januszewski, Ł. Nogal, A. Wójcik: *„Sposób i urządzenie do identyfikacji źródła zakłóceń harmonicznych sieci elektroenergetycznej, zwłaszcza spowodowane przez odbiorniki energii"* (Method and contraption for the identification of the harmonic distortions sources in the power grid, caused by the electrical appliances), Patent application no. P-417463, Jun. 07, 2016.

9. SCIENTIFIC EVENTS

9.1. International scientific events

[Con1] *XIIIrd International Conference "Modern Problems in Radioelectronics, Communication and Computer Engineering: TCSET'2016* (Lviv-Slavske, Ukraine, Feb. 23-26, 2016), Y. Yashchyshyn, G. Bogdan, P. Piasecki (participants).

[Con2] *ISMRM Workshop on Ultra High Field MRI: Technological Advances & Clinical Applications* (Heidelberg, Germany, Mar. 6-9, 2016), E. Piątkowska-Janko, P. Bogorodzki (participants).

[Con3] *International Workshop on Magnetic Particles Imaging: IWMPI 2016* (Lubeck, Germany, Mar. 16-19, 2016), P. Wróblewski (participant).

[Con4] *European Neutrino Meeting* (Genova, Switzerland, Apr. 7-8, 2016), P. Płoński (participant).

[Con5] *21st International Conference on Microwaves, Radar and Wireless Communications: MIKON 2016* (Cracow, Poland, May 9-11, 2016), D. Gryglewski, W. Gwarek, P. Kopyt, J. Modelski, B. Salski, W. Wojtasiak, Y. Yashchyshyn (session co-chairs, members of the Technical Programme Committee), P. Bajurko, G. Bogdan, K. Godziszewski, V. Djaja-Jośko, M. Góralczyk, M. Jarzynka, T. Karpisz, J. Kołakowski, M. Kołakowski, P. Korpas, M. Krysicki, D. Kuchta, P. Piasecki, D. Rosołowski (speakers).

[Con6] *3rd International Workshop on Non-Intrusive Load Monitoring* (Vancouver, Canada, May 14-15, 2016), P. Bilski (speaker)

[Con7] *XVIIth Międzynarodowa Konferencja Zwalczania Hałasu: Noise Control 2016* (Gniew k/Gdańska, Poland, May 22-25, 2016), G. Makarewicz (session chair, speaker), P. Bilski, P. Bobiński, E. Kotarbińska, J. Żera, A. Pietrzak (speakers).

[Con8] *International Microwave Symposium: IMS 2016* (San Francisco, California, USA, May 22-27, 2016), J. Modelski (member of the Steering Committee, chair session), B. Salski (participant).

[Con9] *140th International AES Convention* (Paris, France, Jun. 4-7, 2016), Z. Kulka (participant).

[Con10] *Laser Science to Photonic Applications: CLEO: 2016* (San Jose, California, USA, Jun. 5-10, 2016), B. Salski (participant).

[Con11] *International Conference "Mixed Design of Integrated Circuits and Systems": MIDEX 2016* (Łódź, Poland, Jun. 23-26, 2016), P. Kopyt (participant).

[Con12] *IMEKO TC10: Workshop on New Perspectives in Measurements, Tools and Techniques for System's Reliability, Maintainability and Safety* (Milano, Italy, Jun. 27-Jun. 28, 2016), P. Bilski (speaker).

[Con13] *2016 Meeting of the IMEKO General Council Advisory Board and Technical Board* (Budapest, Hungary, Sept. 4-6, 2016), R. Z. Morawski (member).

[Con14] *IEEE Conference on Signal Processing Algorithms, Architectures, Arrangements and Applications* (Poznań, Poland, Sept. 21-23, 2016), J. Wagner (sepaker).

[Con15] *IMEKO TC1-TC7-TC13 Joint Symposium* (Berkeley, USA, Aug. 3-5, 2016), P. Mazurek (speaker).

[Con16] *"Exploring the Human Connectome" 2016 HCP Course at the Joseph S. Martin Conference Center* at Harvard Medical Center (Boston, USA, Aug. 28-Sept.1, 2016), P. Bogorodzki, E. Piątkowska-Janko (participants).

[Con17] *IMEKO-TC4 Symposium* (Budapest, Hungary, Sept. 7-9, 2016), W. Winiecki, P. Bilski (speakers).

[Con18] *8th Wide Bandgap Semiconductor and Components Workshop* (Harwell, UK, Sept. 12-13, 2016), D. Gryglewski (speaker).

[Con19] *XXX Messtechnisches Symposium des Arbeitskreises der Hochschullehrer für Messtechnik* (Hannover, Germany, Sept. 15-16, 2016), R. Z. Morawski (participant, member of the Editorial Board of the journal *Technisches Messen*).

[Con20] *8th World Congress on Industrial Process Tomography* (Iguassu Falls, Brazil, Sept. 26-29, 2016), W. Smolik (participant).

[Con21] *European Microwave Conference: EuMC 2016* (London, UK, Oct. 1-5, 2016), J. Modelski (member of the Steering Committee, General Assembly European Microwave Association).

[Con22] *Seventh International Conference on Indoor Positioning and Indoor Navigation* (Alcala de Henares, Madrid, Spain, Oct. 4-7, 2016), J. Kołakowski, V. Djaja-Jośko (speakers).

[Con23] *XVI Międzynarodowe Sympozjum: Nowości w Technice Audio i Wideo* (XVIth International Symposium: New Trends in Audio and Video) (Rzeszów, Poland, Oct. 13-15, 2016), Z. Kulka, J. Żera (members of the scientific Committee), P. Bobiński, E. Kotarbińska, M. Lewandowski, G. Makarewicz, A. Pietrzak, (speakers).

[Con24] *Non-Intrusive Load Monitoring Conference: NILM 2016* (London, UK, Oct. 16-19, 2016), P. Bilski (speaker).

[Con25] *43 Międzynarodowa Konferencja i Wystawa: PIKE 2016* (43rd International Conference and Exhibition: PIKE 2016) (Łódź, Poland, Oct. 24-26, 2016), J. Modelski (President of the Programme Council).

[Con26] *International Workshop on Next Generation Nucleon Decay and Neutrino: NNN 16* (Bejin, China, Nov. 01-07, 2016), M. Ziembicki (speaker).

[Con27] *24th Telecommunications Forum: TELFOR 2016* (Belgrade, Serbia, Nov. 22-23, 2016), V. Djaja-Jośko (speaker).

[Con28] *The Thirteenth Annual Conference on Neural Information Processing Systems: NIPS 2016* (Barcelona, Spain, Dec. 5-10, 2016), J. Naruniec, M. Kowalski (participants).

9.2. National scientific events

[Con29] *Ogólnopolska Konferencja Operatorów Komunikacji Elektronicznej – PIKE 2016* (National Conference on Electronic Communications Operators - PIKE 2016) (Jachranka k/Warszawy Apr. 25-27, 2016), J. Modelski (speaker).

[Con30] *XXXIII Konferencja Elektroniki, Telekomunikacji i Energetyki Studentów i Młodych Pracowników Nauki: SECON 2016* (XXXIIIrd Conference on Electronics, Telecommunications and Energetics for Students' and Young Scientists') (Warsaw, Poland, Apr. 18-19, 2016), V. Djaja-Jośko, M. Kołakowski (speakers).

[Con31] *LXIII Otwarte Seminarium z Akustyki* (LXIII Open Seminar on Acoustics) (Białowieża, Poland, Sept. 13-16, 2016), P. Bilski, M. Lewandowski, G. Makarewicz, J. Żera, B. Żłobiński (speakers).

[Con32] *XXVI Ogólnopolski Zjazd Dziekanów Wydziałów Elektrycznych, Elektroniki, Telekomunikacji, Automatyki i Robotyki oraz Informatyki* (XXVIth National Congress of Deans of Faculties: Electrical, Electronics, Telecommunications, Automation and Robotics, and Computer Science) (Częstochowa, Poland, May 31 – Jun. 3, 2016), K. Zaremba (participant).

[Con33] *41 Zjazd Polskiego Lekarskiego Towarzystwa Radiologicznego* (41 Congress of the Polish Medical Society of Radiology) (Kraków, Poland, Jun. 2-4, 2016), P. Bogorodzki, invited lecture: „*Hiperpolaryzowane środki cieniujące do MRI – nowości i przegląd zastosowań"* (Hiperpolarized Contrast Media for MRI – News and Work in Progress Review), E. Piątkowska-Janko, B. Kossowski, J. Orzeł (speakers).

[Con34] *XV Krajowa Konferencja Elektroniki: KKE 2016* (XVth National Conference on Electronics) (Darłówko Wschodnie, Poland, Jun. 6-10, 2016), J. Modzelewski, M. Sypniewski (speakers).

[Con35] *Warsztaty Doktoranckie organizowane przez Polskie Stowarzyszenie Tomografii Procesowej oraz Komitet Elektroniki PAN* (Ph.D. Workshop: WD 2016 organized by: Polish Association for Process Tomography and the Committee on Electrical Engineering of Polish Academy of Sciences) (Lublin, Poland, Jun. 11-13, 2016), R. Szabatin (vice-president of the Programme Committee), W. Smolik (member of the Programme Committee), P. Wróblewski (speaker).

[Con36] *VII Kongres Metrologii* (VIIth Congress of Metrology) (Nałęczów-Lublin, Jun. 28 – Jul. 01, 2016), A. Wójcik (participant).

[Con37] *XI Konferencja Naukowa: Systemy pomiarowe w badaniach naukowych i w przemyśle: SP'2016* (XIth Scientific Conference: Measurement Systems in Research and in Industry) (Łagów, Poland, Jun. 12-15, 2016).

[Con38] *Krajowa Konferencja Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2016* (National Conference on Radiocommunications and Broadcasting) (Kraków, Poland, Jun. 27-29, 2016), J. Cichocki, J. Modelski, W. Skarbek, Y. Yashchyshyn (members of the Programme Committee), P. Bajurko, P. Bobiński, G. Bogdan, K. Godziszewski, W. Kazubski, J. Kołakowski, M. Kołakowski, R. Michnowski, M. Nowak, P. Korpas, K. Radecki, B. Salski, V. Djaja-Jośko, K. Woźna (speakers).

[Con39] *XXXII Krajowe Sympozjum Telekomunikacji i Teleinformatyki: KSTiT 2016* (XXXIInd National Symposium on Telecommunication and Teleinformatics) (Gliwice, Poland, Sept. 26-28, 2016), J. Modelski, W. Skarbek (members of the Programe Committee).

[Con40] *Novel Understanding of Resonant Modes in YIG Microwave Filters Experimantal and Electrodynamic Study* (Poznań, Poland, Oct. 12, 2016), seminar organized by the Physics Faculty, A. Mickiewicz University in Poznań in the frame of series: *Modern Trends in Physics Research*, B. Salski (speaker).

[Con41] *XVII Seminarium – Radiokomunikacja i Techniki Multimedialne* (XVIIth Seminar Radiocommunications and Multimedia Technologies) (Warsaw, Poland, Dec. 7, 2016), J. Naruniec, Ł. Błaszczyk, M. Trochimiuk, M. Huryn, M. Kołakowski, Ł. Kwiatkowski, P. Piotrowski, R. Protasiuk, J. Sobolewski, P. Symonides, N. Zienkowicz (speakers).

10. AWARDS AND DISTINCTIONS

State Medals

Marek Krawczyk, Prof. M.D., Ph.D.

Krzyż Komandorski Orderu Odrodzenia Polski (Commander's Cross of the Order of Polonia Restituta).

Andrzej Podgórski, Ph.D.,
Mirosław Lubiejewski

Medal Złoty za Długoletnią Służbę (Golden Medal for Long-lasting Service).

Ewa Piątkowska-Janko, Ph.D.,
Juliusz Modzelewski, Ph.D.

Medal Komisji Edukacji Narodowej (Medal of the National Education Committee).

Piotr Brzeski, Ph. D.,
Jacek Cichocki, Ph. D.,
Wojciech Gwarek, Prof. D. Sc.,
Władysław Skarbek, Prof. D. Sc.,
Wiesław Winiecki, Prof. D. Sc.

Medal Srebrny z okazji rocznicy 100-lecia Politechniki Warszawskiej (Silver Medal in Commemoration of the 100th Anniversary of WUT).

Zbigniew Kulka, Prof. D.Sc.,
Andrzej Skrzypkowski,
Wojciech Wojtasiak, Assoc. Prof.,
Yevhen Yashchyshyn, D.Sc., Prof.

Medal Brązowy z okazji rocznicy 100-lecia Politechniki Warszawskiej (Bronze Medal in Commemoration of the 100th Anniversary of WUT).

Awards granted by international bodies

The 2016 Breakthrough Prize in Fundamental Physics

Krzysztof Zaremba, Prof. D,Sc.,
Janusz Marzec, D. Sc., Prof.,
Michał Dziewiecki, Ph.D.,
Robert Kurjata, Ph.D.,
Piotr Płoński, Ph.D.,
Marcin Ziembicki, M.Sc.

Award for the fundamental discovery and exploration of neutrino oscillations.

Award of the Polish Academy of Sciences

Bartłomiej Salski, Assoc. Prof.

Awards of the Rector

Zbigniew Kulka, Prof. D.Sc.

Individual award I° for the outstanding scientific and didactic achievements.

Krzysztof Zaremba, Prof. D.Sc.

Individual II° award for the organizational achievements.

Grzegorz Pastuszak, Assoc. Prof.,
Bartłomiej Salski, Assoc. Prof.,
Waldemar Smolik, Assoc. Prof.

Individual II° award for the D.Sc. thesis.

Wojciech Gwarek, Prof. D.Sc.,
Wiesław Winiecki, Prof. D.Sc.

Individual III° award for the organizational achievements.

Wiesław Winiecki, Prof. D.Sc.,
Piotr Bilski, Assoc. Prof.,
Robert Łukaszewski, Ph.D.
Adrian Bilski, M.Sc.

Team award for the organization of the *8th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: IDAACS'2015*.

Zbigniew Kulka, Prof. D.Sc.,
Jan Żera, D.Sc., Prof.
Marcin Lewandowski, Ph.D.,

Team award for the organization of the *16th International Symposium on Sound Engineering and Tonmeistering: ISST 2015*.

Award of the Students' of the Faculty

Tymon Rubel, Ph.D.,
Mateusz Krysicki, M.Sc.

"Złota Kreda" ("Golden Chalk" Award).

Award granted for the Ph.D. students'

Vitomir Djaja-Jośko, M.Sc.

The first award for the Ph.D. student in *the XXXIIIrd Conference on Electronics, Telecommunications and Energetics for Students' and Young Scientists'*, organized by the Military University of Technology (WAT).

Award of the Foundation for the Development of Radiocommunications and Multimedia Technologies in the Young Authors' competition

Grzegorz Bogdan, M.Sc.

The first award for the paper titled: *"Szerokopasmowy szyk antenowy z polaryzacją kołową"* (Wideband Planar Antenna Array with Circular Polarization).

Vitomir Djaja-Jośko, M.Sc.

The second award for the paper titled: *"Metoda bezprzewodowej synchronizacji węzłów I korelacji wyników pomiarów TDOA w ultraszerokopasmowym systemie lokalizacyjnym"* (A Method for Wireless Anchors Synchronization and Correction of TDOAS in the UWB Localization System).

Jakub Sobolewski, B.Sc.

The preferance paper titled: *„Promiennik łatkowy na podłożu LTCC na pasmo 120 GHz"* (A 120 GHz Patch Radiator on LTCC Substrate).

Piotr Włodarczyk, B.Sc.

The preferance paper titled: *„Projekt anteny paskowej na pasmo sub-terahercowe przeznaczonej do realizacji w technologii LTCC"* (Strip Antenna Design on Sub-Terahertz Bandwidth Destinated to Construct in LTCC Technology).

Award of the Faculty of Electronics and Information Technology, WUT in the Ph.D. students' competition

Grzegorz Bogdan, M.Sc.

The second award for the leading role in paper titled: *"Time-Modulated Antennas and Wireless Propagation Letters"*.

Scholarships of the Foundation for the Development of Radiocommunications and Multimedia Technologies granted in 2016

For preparing D.Sc. Thesis

Jacek Naruniec

For preparing Ph.D. Thesis

Łukasz Błaszczyk
Maciej Trochimiuk

For preparing M.Sc. Thesis

Maria Huryn, Marcin Kołakowski, Łukasz Kwiatkowski, Jakub Sobolewski, Piotr Symonides, Piotr Włodarczyk

11. STATISTICAL DATA (as of Dec. 31st of each year)

SPECIFICATION	2013	2014	2015	2016
academic staff [posts]				
total	60,68	60,68	60,23	63,58
tenured professors	5	6	5,5	5,5
professors	7,5	5,5	5,5	8,5
associate professors	0	2,75	5	3
assistant professors	39,90	37,90	33,65	32,25
readers	1	1	1	1
senior lecturers	4,53	4,53	4,08	5,33
assistants	2,75	3	5,5	8
Ph.D. students [persons]				
total	42	39	45	38
with scholarship	30	28	34	31
without scholarship	12	11	11	7
technical and administrative staff [posts]				
total	19,75	17,25	17,75	16,75
senior R&D associates	1,75	1,25	1,25	1
R&D associates	5,5	5,5	5	5
administrative associates	10,5	9,5	9,5	8,75
service workers	2	1	2	2
temporary staff	4,3	0	0	2
library resources				
books (volumes)	11165	11181	11197	11212
books (titles)	7276	7292	7307	7323
journals (subscribtions)	83	83	83	83
teaching activities				
basic courses	69	61	61	62
advanced courses	34	35	34	30
other courses	54	47	47	50
international projects, courses and lectures	3	3	4	1
research projects				
total	47	46	48	50
international	5	6	3	3
granted by the Ministry	22	22	21	19
granted by the University	12	11	17	15
other	8	7	8	13
titles and degrees awarded				
Prof. titles	2	0	0	1
D.Sc. degrees	0	3	3	0
Ph.D. degrees	8	5	5	7
M.Sc. degree (regular studies + evening studies)	61+7	62+2	63+2	48+1
M.Sc. degree (studies in English)	1	1	1	1
B.Sc. degrees (regular studies + evening studies)	106+3	98+4	69+5	72+7
B.Sc. degrees (studies in English)	3	2	2	0
B.Sc. degrees e-learning	1	2	2	3
publications				
total	183	215	205	207
sci.-tech. books and chapters in books	7	8	2	2
sci.-tech. papers in journals - total	77	83	89	65
JCR-ICI list (IF>0)	36	44	33	37
MSHE list	38	36	52	28
in other journals	3	3	4	9
sci.-tech. papers in conference proceedings	74	83	81	107
other publications	25	41	33	24
research reports	29	19	24	21
scientific events attended by the staff	35	46	42	41

APPENDIX:

EXPLANATORY NOTE ON POLISH ACADEMIC AND PROFESIONAL TITLES, DEGREES AND POSTS

This note contains the definitions of academic and professional titles, degrees and posts held by the staff of the Institute of Radioelectronics and Multimedia Technology.

The following professional titles are awarded by Polish higher-education institutions:

- the ***inżynier (inż.)*** title, translated here as **B.Sc.**, is awarded to the students completing undergraduate studies in the fields of study related to engineering and technology;
- the ***magister (mgr)*** title, translated here as **M.Sc.**, is awarded to the students completing graduate studies in the fields of study related to sciences;
- the ***magister (mgr)*** title, translated here as **M.A.**, is awarded to the students completing graduate studies in arts and humanities;
- the ***magister inżynier (mgr inż.)*** title, translated here as **M.Sc.**, is awarded to the students completing graduate studies in the fields of study related to engineering and technology.

The academic degrees, the *doctor* and *doctor habilitowany* degrees, are awarded by the scientific councils of higher-education institutions or other scientific institutions.

The degree of ***doktor (dr)***, translated here as **Ph.D.**, is conferred on a person who:

- is the holder of the professional title of *magister* or *magister inżynier*;
- has successfully passed doctoral examinations in a selected research discipline;
- has submitted and successfully defended a doctoral thesis, favorably assessed by two reviewers.

The doctoral thesis, prepared under the supervision of a research adviser, should provide an original solution of a research problem and demonstrate general theoretical knowledge of the candidate in a given research discipline, as well as confirm his/her skills to conduct research work autonomously.

The degree of ***doktor habilitowany (dr hab.)***, translated here as **D.Sc.**, is conferred on a person who:

- is the holder of the academic degree of *doktor*;
- has remarkable scientific achievements;
- has significantly contributed to the development of a given research discipline;

and his/her contribution has been favorably assessed by four reviewers and approved by the scientific council of a higher-education institution or other scientific institution. The holder of the *doktor habilitowany* degree is authorized to be the advisor of Ph.D. students.

The academic title of ***profesor (prof.)*** is conferred by the President of the Republic of Poland. This title may be conferred on a person who:

- is the holder of the degree of *doktor habilitowany*;
- has scientific achievements significantly exceeding those required of *doktor habilitowany*;
- has remarkable academic achievements, including formation of academic staff.

The combination of the *profesor* title and the *doktor habilitowany* degree (***professor doktor habilitowany – prof. dr hab.***) is translated here as **Prof. D.Sc.**

The minimum requirements concerning the academic posts are as follows:

- for the post of ***asystent****,* translated here as ***Assistant*** − the professional title of *magister* or *magister inżynier*;
- for the post of ***starszy wykładowca***, translated here as ***Senior Lecturer*** − the *doktor* degree;
- for the post of ***docent****,* translated here as ***Reader*** − the *doktor* degree;
- for the post of ***adiunkt****,* translated here as ***Assistant Professor*** − the *doktor* degree;
- for the post of ***wykładowca***, translated here as ***Lecturer*** − the professional title of *magister* or *magister inżynier*;
- for the post of ***profesor nadzwyczajny****,* translated here as ***Professor*** − the *doktor habilitowany* degree;
- for the post of ***profesor zwyczajny****,* translated here as ***Tenured Professor*** − the *profesor* title.

More details concerning academic and professional titles, degrees and posts may be found in the Act on Higher Education od 2005 (with further adendmends)