INSTITUTE OF RADIOELECTRONICS AND MULTIMEDIA TECHNOLOGY

WARSAW UNIVERSITY OF TECHNOLOGY

FACULTY OF ELECTRONICS AND INFORMATION TECHNOLOGY

ANNUAL REPORT

2017

Warsaw, January 2018

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From the Director

Welcome to the 2017 edition of the Annual Report issued by the Institute of Radioelectronics and Multimedia Technology!

The past year was full of discussions about reforming higher education. New regulations are to be introduced in 2018. It is a good opportunity to look at possible changes and be in the forefront of the transition process. The main emphasis will be on the intensification of scientific research. This should improve quality of the education process and increase participation in international projects. It should be noted that in previous years the Institute established complex infrastructure, making the highest level research possible. This was clearly visible in 2017, in which annual turnover reached almost 1 million Euro. The widely recognized competence and excellence of our staff was confirmed. One of the key factors making this success possible was diversity of our activities, spanning from fundamental sciences to commercial and military contracts, focused on applied engineering. Therefore in the upcoming year we plan to support multidisciplinary projects, opening new perspectives and promising long-term cooperation with companies present on domestic and international market.

There are multiple possible practical applications following research at the Institute. To make this happen, spin-off companies have to be founded. They allow for transfer of technology and development of new commercial solutions. The first endeavor of this kind is EMArges Ltd., recently founded by two Associate Professors employed at the Institute. The aim of the company is to commercialize research outcomes related to microwave characterization of materials, development of microwave and mm-wave sources.

Another challenge we had to face was the evaluation of scientific institutions, driving the competition between co-workers and positively influencing the quality of ongoing research with its wider dissemination. Statistical analysis confirms we are heading in the right direction as the total number of publications year-by-year significantly increased in 2017, with 40 articles published in journals from the JCR list and 5 patents granted. We should definitely keep it up in 2018!

The measure of the efforts' quality for our teachers and lecturers are numerous awards. Therefore it is a real pleasure to see two Golden Chalk prizes granted by the Faculty students to our colleagues, Dr. Jacek Naruniec and M.Sc. Mateusz Krysicki. We are strongly convinced that such achievements will additionally contribute to the inflow of talented students choosing our Institute for graduate studies.

It should be also noted that several colleagues received individual and team awards of the Rector, including medals for long-lasting service at our University (Mrs. Anna Tratkiewicz). Two members of our staff have received highly prestigious awards, i.e. Golden Cross of Merit for Dr. Karol Radecki and Medal of National Education Committee for Prof. Janusz Marzec. Moreover, Prof. Jan Żera received the Professor title from the President of the Republic of Poland, Dr Paweł Kopyt has been awarded for his achievements with D.Sc. degree, while two students received their Ph.D degrees.

I want to thank all the colleagues working at the Institute of Radioelectronics and Multimedia Technology for their involvement in our activities, hard work and dedicated service. It is my pleasure to express a deep gratitude to our Grantors, Sponsors, Co-operators and all Friends of the Institute without whom we would have not been able to achieve our aims.

Warsaw, January 2018

Professor Wiesław Winiecki

Classification of publications presented in this Report
is in accordance with the rules in force in 2017

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 in 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, ICARUS – Italy), 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 Nanoparticle 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

Wiesław Winiecki, Prof. D.Sc.,
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Anna Smenda
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Deputy Director for Research

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Secretariat

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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
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Senior academic staff

Wiesław Winiecki, Prof. D.Sc., Professor
Piotr Bilski, D.Sc., Professor
Ewa Kotarbińska, Ph.D., Assistant Professor (0.25 – till Sept. 2017).
Marcin Lewandowski, 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

Robert Łukaszewski, Ph.D. (Assistant from Jan. 2017)
Agnieszka Pietrzak, M.Sc., Assistant

Technical staff

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

Ph.D. Students

Krzysztof Dowalla, M.Sc., from Feb. 2017
Jakub Pach, M.Sc., from Feb. 2013
Bartosz Połok, M.Sc., from Oct. 2015
Agnieszka Pietrzak, M.Sc., from Feb. 2015
Augustyn Wójcik, M.Sc., from Oct. 2015
Bartosz Żłobiński, M.Sc., from Feb. 2015

Retired

Zbigniew Kulka, Prof. D.Sc.,
Ewa Kotarbińska, Ph.D.,
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:

- fundamentals 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 consumption around 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

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Senior academic staff

Wojciech Gwarek, Prof. D.Sc., Tenured Professor (till Sept. 2017)
Stanisław Rosłoniec, Prof. D.Sc., Tenured Professor (0.5)
Paweł Kopyt, D.Sc., Associate Professor
Bartłomiej Salski, D.Sc., Associate Professor
Małgorzata Celuch, Research Assist. (0.5, till Jun. 2017)
Daniel Gryglewski, 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

Wojciech Gwarek, Prof. D.Sc.,
Tadeusz Morawski, Prof. D.Sc.

The Microwave and Radiolocation Engineering Division conducts scientific and applied research around 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 2017 included: design of Front-Ends for wireless systems, radar applications (oscillators, synthesizers, modulators, amplifiers, transmitter/receiver modules), high-power high frequency stability sources for microwave heating and GaN HEMT structure topology design; 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

Janusz Marzec, D.Sc., Professor
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Senior academic staff

Krzysztof Zaremba, Prof. D.Sc., Tenured Professor
Marek Krawczyk, Prof. M.D. Ph.D. (0.5)
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
Dariusz Radomski, Ph.D., Research Assistant Professor
Tymon Rubel, Ph.D., Assistant Professor
Andrzej Rychter, Ph.D., Assistant Professor
Błażej Sawionek, Ph.D., Assistant Professor (0.5, till Sept. 2017)
Piotr Brzeski, Ph.D., Senior Lecturer (0.5)
Tomasz Jamrógiewicz, M.Sc., Senior Lecturer (0.5)
Robert Kurjata, Ph.D. (Senior Lecturer to Jun. 2017, Assistant from Jul. 2017)
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)
Marcin Ziembicki, M.Sc., Assistant

Technical staff

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.

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;
- 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 agents;
- 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;
- characterization and modeling of photosensor for high-energy physics and astronomy experiments;
- 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

Józef Modelski, Prof. D.Sc., Tenured Professor
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Senior academic staff

Yevhen Yashchyshyn, Prof. D.Sc., Professor
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, till Sept. 2017)
Sebastian Kozłowski, Ph.D., Assistant Professor
Krzysztof Kurek, Ph.D., Assistant Professor
Mirosław Mikołajewski, Ph.D., Assistant Professor
Karol Radecki, Ph.D., Assistant Professor (0.5, till Sept. 2017)
Henryk Chaciński, M.Sc., Senior Lecturer (0.5)
Tomasz Keller, Ph.D., Senior Lecturer (0.33)
Ryszard Michnowski, Ph.D. (Assist. Prof. 1 till Jan. 2017, Senior Lecturer 0.5 from Feb. 2017 till Jun. 2017**)**

Junior academic staff

Grzegorz Bogdan, M.Sc., Assistant (0,5)
Vitomir Djaja-Jośko, M.Sc, Assistant (from Sept. 2017)
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

Ph.D. students

Łukasz Błaszczyk, M.Sc., from Oct. 2013
Grzegorz Bogdan, M.Sc., from Oct. 2013
Vitomir Djaja-Jośko, M.Sc., from Oct. 2015
Marcin Kołakowski, M.Sc., from Oct. 2016
Andrzej Lewandowski, M.Sc., from Oct. 2017
Tomasz A. Miś, M.Sc., from Oct. 2017
Denys Nyzovets, M.Sc., from Oct. 2016
Przemysław Piasecki, M.Sc., from Oct. 2013
Jakub Sobolewski, M.Sc., from Feb. 2017
Arkadiusz Wójcik, M.Sc., from Oct. 2017

Retired

Jan Ebert, Prof. D.Sc.,
Stefan Hahn, Prof. D.Sc.,
Waldemar Kiełek, D.Sc.,
Tomasz Kosiło, Ph.D.,
Karol Radecki, Ph.D.

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, 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

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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

Przemysław Buczkowski, M.Sc., from Oct. 2016
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
Zbigniew Nasarzewski, M.Sc., from Feb. 2017
Rafał Pilarczyk, M.Sc., from Oct. 2017
Rafał Protasiuk, M.Sc., from Oct. 2016
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 analyzers 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

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Tomasz Jamrógiewicz, M.Sc. Organizing coordinator
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Monika Feluś (Różycka), M.A.
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1.5. Other Institute's Units

1.5.1 Library

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1.5.2 Accounting Department

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Staff

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Zdzisława Fenikowska, M.A.
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1.5.3 Supply Section

Staff

Andrzej Laskowski
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Andrzej Skrzypkowski (0.5, till Apr. 2017)
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1.5.4 Office of the Foundation for the Development of Radiocommunication and Multimedia Technology

Anna Czarnecka, M.Sc., Senior R&D Engineer
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2. STAFF

2.1. Senior academic staff

Paweł Bajurko
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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.
Recipient of a team award of the Rector ('17).
[Edu89]; [Pro13], [Pro14], [Pro29], [Pro47]; [Pub52], [Pub69], [Pub73], [Pub94], [Pub131], [Pub133]; [Pat1], [Pat2], [Pat3], [Pat4], [Pat5].

Piotr Bilski
room: 127, phone: +48 22 2347644
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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.
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[Edu1], [Edu21], [Edu68]; [Pro28], [Pro31]; [MSc11], [MSc23], [MSc28]; [BSc6], [BSc55], [BSc56], [BSc64]; [Pub1], [Pub2], [Pub3], [Pub4], [Pub5], [Pub6], [Pub7], [Pub26], [Pub51], [Pub79], [Pub82], [Pub83], [Pub84], [Pub119].

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[Edu1], [Edu6], [Edu53]; [Pro31]; [MSc14], [MSc18], [MSc32]; [BSc28], [BSc73]; [Pub26], [Pub37].

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[Edu82]; [Pro6], [Pro18], [Pro30], [Pro40], [Pro41]; [Pub2], [Pub14], [Pub28], [Pub44], [Pub74], [Pub139], [Pub140], [Pub143], [Pub146], [Pub148].

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[Edu8], [Edu9], [Edu22], [Edu72]; [Pro30], [Pro38]; [Pub57], [Pub58].

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[Edu61], [Edu98]; [Pro22], [Pro43]; [MSc50]; [BSc37]; [Pub136].

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[Pro21].

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[Edu2], Edu97]; [Pro25]; [BSc72].

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[Edu12], [Edu42], [Edu47], [Edu100], [Edu102], [Edu103], [Edu121]; [Pro8], [Pro23], [Pro43]; [Pub60].

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[Edu10], [Edu29]; [Pro13], [Pro29], [Pro39]; [Pub47].

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[Edu49]; [Pro4], [Pro5], [Pro7], [Pro30], [Pro32]; [MSc6], [MSc17], [MSc21], [MSc35]; [BSc14], [BSc43], [BSc66]; [Pub55], [Pub56], [Pub57], [Pub58], [Pub138], [Pub139].

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[Pro1], [Pro5], [Pro7], [Pro30]; [Pub8], [Pub9], [Pub10], [Pub11], [Pub16], [Pub17], [Pub18], [Pub19], [Pub20], [Pub21], [Pub22], [Pub23], [Pub24], [Pub58].

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[Edu13], [Edu69], [Edu115]; [Pro22]; [MSc24], [MSc37]; [BSc1], [BSc63].

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[Edu56], [Edu94]; [Pro12], [Pro45], [Pro46], [Pro48]; [BSc39].

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[Edu22], [Edu28], [Edu67], [Edu72]; [Pro11]; [Pub43].

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[Edu41], [Edu44]; [Pro22]; [MSc25], [MSc45]; [BSc20], [BSc68], [BSc69], [BSc70]; [Pub103], [Pub126].

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[Edu16], [Edu33], [Edu57], [Edu114]; [Pro30]; [BSc12], [BSc36].

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[Edu5], [Edu59], [Edu126]; [Pro25]; [MSc1], [MSc48]; [BSc7].

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[Edu19], [Edu62], [Edu92]; [Pro8], [Pro23]; [MSc36], [MSc49]; [BSc2], [BSc27], [BSc29], [BSc81]; [Pub4], [Pub5], [Pub29], [Pub60], [Pub95], [Pub96], [Pub141].

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[Edu3], [Edu10]; [Pro4], [Pro5], [Pro7], [Pro30]; [Pub55], [Pub56], [Pub57], [Pub58].

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[Edu75]; [Pro3], [Pro11], [Pro15], [Pro17], [Pro21], [Pro49]; [DSc1]; [Pub30], [Pub32], [Pub33], [Pub34], [Pub50], [Pub122], [Pub144].

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[Pro12], [Pro21], [Pro34], [Pro45], [Pro46]; [BSc49].

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[Edu46], [Edu70], [Edu101], [Edu119], [Edu120]; [Pro27]; [Pub62].

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[Edu77], [Edu85]; [Pro14], [Pro27]; [MSc27]; [BSc77]; [Pat2], [Pat3], [Pat4], [Pat5].

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[Pro43].

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[Edu12], [Edu51], [Edu90]; [Pro24], [Pro33], [Pro43]; [MSc16].

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[Edu58]; [Pro31]; [MSc13]; [BSc10], [BSc18], [BSc75]; [Pub104].

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[Edu17]; [Pro31]; [BSc57], [BSc65]; [Pub104], [Pub105].

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[Edu18], [Edu22], [Edu45], [Edu72], [Edu73], [Edu87]; [Pro4], [Pro5], [Pro7], [Pro30]; [Pub15], [Pub17], [Pub18], [Pub19], [Pub20], [Pub21], [Pub22], [Pub23], [Pub56], [Pub57].

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[Edu20], [Edu25], [Edu76]; [Pro16], [Pro21]; [BSc48]; [Pub80].

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[Pro8], [Pro23]; [MSc43]; [Pub4].

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[Edu30], [Edu38], [Edu39], [Edu116]; [Pro9], [Pro26], [Pub45]; [Pub106], [Pub107].

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[Edu23]; [Pro25]; [MSc4], [MSc5], [MSc30]; [BSc13], [BSc46], [BSc53]; [Pub66], [Pub108].

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[Edu72], [Edu73], [Edu96]; [Pro20], [Pro24], [Pro43]; [Pub83], [Pub101], [Pub109].

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[Edu26], [Edu30], [Edu38], [Edu39], [Edu129]; [Pro26]; [Pub45], [Pub81], [Pub106], [Pub107], [Pub127], [Pub145], [Pub147].

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[Edu27], [Edu40], [Edu79]; [Pro22]; [MSc10], [MSc20]; [BSc32], [BSc54]; [Pub46], [Pub102], [Pub110].

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[Edu69]; [Pro22], [Pro42]; [PhD2]; [MSc22]; [Pub136].

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[Edu33], [Edu130]; [Pro6], [Pro18], [Pro30], [Pro40], [Pro41]; [MSc41], [MSc46]; [BSc40], [BSc50], [BSc52], [BSc69]; [Pub39], [Pub74], [Pub138], [Pub139], [Pub143], [Pub146], [Pub148].

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[Edu11], [Edu30], [Edu38], [Edu39]; [Pro26]; [BSc22], [BSc23].

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[Edu112], [Edu124]; [Pro23]; [Pub4], [Pub62].

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[MSc12]; [Pub68], [Pub121], [Pub123], [Pub130].

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[Edu107]; [Pro12], [Pro21], [Pro45], [Pro46], [Pro48]; [BSc82], [BSc84].

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[Edu28], [Edu43]; [Pro15], [Pro17], [Pro19], [Pro49]; [BSc44]; [Pub30], [Pub32], [Pub33], [Pub34], [Pub42], [Pub88], [Pub122], [Pub144].

Błażej Sawionek (employed to Sept. 2017)
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M.Sc. ('91), Ph.D. ('99); medical and nuclear engineering; **Assistant Professor** (0.5), Nuclear and Medical Electronics Division.
[Edu15]; [Pro30]; [BSc8], [BSc19]; [Pub74], [Pub146].

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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-); Member of the Programme Committee of the National Conference of Radiocommunications and Broadcasting ('01-).
[Edu63], [Edu64], [Edu83]; [Pro22]; [MSc26], [MSc34]; [Pub38], [Pub53], [Pub87], [Pub118], [Pub120], [Pub135].

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M.Sc. ('91), Ph.D. ('97), D.Sc. ('14); computer engineering, biomedical engineering, computer tomography; **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-).
[Edu65], [Edu80]; [Pro10], [Pro30], [Pro37], [Pro38], [Pro51]; [MSc8]; [BSc11], [BSc33]; [Pub35], [Pub36], [Pub43], Pub57], [Pub63], [Pub64], [Pub65], [Pub70], [Pub71], [Pub75], [Pub76].

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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 Processing* ('16-); Recognized Reviewer of *Signal Processing* ('17-).
[Edu54], [Edu55], [Edu124]; [Pro27]; [PhD1]; [BSc4], [BSc34]; [Pub124].

Maciej Sypniewski
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M.Sc. ('83), Ph.D. ('96); microwave technique; **Assistant Professor**, Microwave and Radiolocation Engineering Division.
[Edu27]; [Pro21]; [MSc32], [MSc33], [MSc47].

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M.Sc. ('75), Ph.D. ('86), D.Sc. ('03); Prof. Title ('11); measurement and instrumentation; **Professor**, Electroacoustics Division.
Director of the Institute of Radioelectronics and Multi-

media Technology (’16-);
Chairman of the Rector Committee on Research and Scientific Instrumentation (’12-); Vice-president of Polish Society for Measurement, Automatic Control and Robotics POLSPAR (’11-), Chairman of Measurement Committee of POLSPAR (’04-); Member of the Editorial Board of the *International Journal of Computing* (‘06-); Member of the Programme Board in Journal *Measurement Automation Monitoring MAM* (earlier titled as *Pomiary Automatyka Kontrola [PAK]* (‘07-); Reviewer of the *IEEE Transactions on Instrumentation and Measurement* (‘03-), Metrology and Measuring Systems (07-); Member of the International Program Committee of the IEEE Conference on Intelligent Data Acquisition and Advanced Computing Systems IDAACS (‘01-), Member of the IEEE IDAACS International Advisory Board (‘09-), Coordinator of the Special Stream in Computer Systems for Healthcare and Medicine of the IEEE IDAACS’2017; Member of the Scientific and Programme Committees of the following National Conferences: Measurement Systems in the Scientific Research and Industry (‘01-), Dynamic Measurements (‘06-), Fundamental Problems of Metrology (‘09-); Recipient of two awards of the Rector (’17).
[Edu1], [Edu32], [Edu74], [Edu99]; [Pro9], [Pro28]; [BSc85]; [Pub1], [Pub7], [Pub84], [Pub112], [Pub128], [Pub129].

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M.Sc. (‘84), Ph.D. (‘98), D.Sc. (’15); microwave technique; **Professor**, Microwave and Radiolocation Engineering Division, Head of Division (’17-).
Member of IEEE (’96-); Member of the International Microwave Conference: MIKON (2016-).
[Edu34]; [Pro12], [Pro21], [Pro43], [Pro45], [Pro46], [Pro48]; [Pub41], [Pub142].

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M.Sc. (‘79), Ph.D. (‘86), D.Sc. (‘06), Prof. Title (’16); telecommunications; **Professor**, Radiocommunications Division.
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 Micro. Theory and Techniques* (‘04-), *IEEE Trans 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-); Recipient of a team award of the Rector (’17).
[Edu4], [Edu22], [Edu131]; [Pro2], [Pro13], [Pro14], [Pro18], [Pro29], [Pro39], [Pro44]; [Pub47], [Pub48], [Pub49], [Pub52], [Pub59], [Pub67], [Pub73], [Pub131], [Pub132], [Pub133], [Pub139], [Pub140].

Krzysztof Zaremba
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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.
Member of CERN (‘89-); Member (’05-) and Chairman of the University Council Committee on Property and Finances (‘16-); Member of the Programme Board of the Institute of Applied Researches, WUT (’14-); 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 Scientific Board of the National Centre for Nuclear Nuclear Research (’15-’17); Member of the Scientific Board of the Nałęcz Institute of Biocybernetics and Biomedical Engineering, Polish Academy of Science (’15-); Member of the Scientific Board of the Automotive Industry Institute (17’-); Member of the Scientific Board of the Institute of the Nuclear Chemistry and Technology (17’-); Chemical 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 (’17).
[Edu50], [Edu73]; [Pro1], [Pro4], [Pro5], [Pro7], [Pro30]; [Pub8], [Pub9], [Pub10], [Pub11], [Pub12], [Pub13], [Pub15], [Pub16], [Pub17], [Pub18], [Pub19], [Pub20], [Pub21], [Pub22], [Pub23], [Pub24], [Pub56], [Pub57].

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 Engineering F. Chopin University of Music (‘04-); Member of the Technical Committees of the Polish Committee for Standardization (’09-).
[Edu22], [Edu36], [Edu73], [Edu78]; [Pro31], [Pro50], [Pro52], [Pro53]; [Prof1]; [MSc44]; [Pub31], [Pub77], [Pub117], [Pub149].

2.2. Junior academic staff

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Vitomir Djaja-Jośko, M.Sc., Assistant (from Sept. 2017)
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Konrad Godziszewski, M.Sc., Assistant (0.5)
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2.3. Ph.D. students (the third-level studies)

Ph.D. Student	**(tutor)**
Przemysław Buczkowski, M.Sc.	*(W. Skarbek)*
Grzegorz Bogdan, M.Sc.*	*(Y. Yashchyshyn)*
Vitomir Djaja-Jośko, M.Sc.	*(J. Modelski)*
Krzysztof Dowalla, M.Sc.	*(W. Winiecki)*
Monika Drabik, M.Sc.	*(P. Bogorodzki)*
Marcin Góralczyk, M.Sc.	*(W. Wojtasiak)*
Daniel Grzywczak, M.Sc.*	*(W. Skarbek)*
Grzegorz Gwardys, M.Sc.	*(W. Skarbek)*
Tomasz Karpisz, M.Sc.	*(B. Salski)*
Marcin Kołakowski, M.Sc.	*(J. Modelski)*
Bartosz Kossowski, M.Sc.*	*(P. Bogorodzki)*
Marek Kowalski, M.Sc.	*(W. Skarbek)*
Mateusz Krysicki, M.Sc.	*(W. Wojtasiak)*
Jacek Kryszyn, M.Sc.*	(*W. Smolik)*
Dawid Kuchta, M.Sc.	*(W. Wojtasiak)*
Andrzej Lewandowski, M.Sc.*	*(J. Modelski)*
Paweł Mazurek, M.Sc.	*(R. Z. Morawski)*
Tomasz A. Miś, M.Sc.	*(J. Modelski)*
Zbigniew Nasarzewski, M.Sc.*	*(W. Skarbek)*
Denys Nyzovets, M.Sc.*	*(Y. Yashchyshyn)*
Jarosław Orzeł, M.Sc.*	*(P. Bogorodzki)*
Jakub Pach, M.Sc*.	(*P. Bilski)*
Przemysław Piasecki, M.Sc.*	*(Y. Yashchyshyn)*
Rafał Pilarczyk, M.Sc.*	*(W. Skarbek)*
Agnieszka Pietrzak, M.Sc.	*(J. Żera)*
Bartosz Połok, M.Sc.*	(*P. Bilski)*
Rafał Protasiuk, M.Sc.	*(W. Skarbek)*
Adam Raniszewski, M.Sc.	*(W. Wojtasiak)*
Jakub Sobolewski, M.Sc.	*(Y. Yashchyshyn)*
Mateusz Stosio, M.Sc.*	*(W. Smolik)*
Jakub Wagner, M.Sc.	*(R. Z. Morawski)*
Damian Wanta, M.Sc.	*(W. Smolik)*
Michał Wieteska, M.Sc.	*(P. Bogorodzki)*
Arkadiusz Wójcik, M.Sc.	*(J. Modelski)*
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
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Anna Dobrzyńska, Financial Spec. (0.75 to Jun. 2017, 0.5 from Jul. 2017)
room: 421, phone: +48 22 2347743
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Izabela Dudek, Secretary
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Monika Feluś (Różycka), M.A., Secretary
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Zdzisława Fenikowska, M.A., Financial Spec.
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Aleksandra Jefimowicz, M.A., Financial Spec.
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Mirosław Lubiejewski, Foreman
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Grzegorz Makarewicz, Ph.D., Senior R&D Eng. (0,5)
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Janina Nowak, Accountant
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Andrzej Owczarek, M.Sc., Senior Devel. Eng. (0.25 till Feb. 2017, 0.5 from Mar. 2017)
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temporary research staff of the projects: *CELTA, **Methods of Protection and Defense Against the HP

3. TEACHING ACTIVITIES

(the summer semester of the academic year 2016/2017 and the winter semester of the academic year 2017/2018)

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
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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] *Analog and Digital Radio Broadcasting Systems* (Systemy radiofonii analogowej i cyfrowej - RAC); 45 h/sem.; H. Chaciński.

[Edu3] *Analysis of Measurement Data in Medicine* (Analiza danych pomiarowych w medycynie – ADP); 45 h/sem.; B. Konarzewski.

[Edu4] *Antennae* (Anteny – ANT); 45 h/sem.; Y. Yashchyshyn.

[Edu5] *Basic Radio-frequency Circuits* (Podstawowe układy radioelektroniczne – PURAD); 45 h/sem.; W. Kazubski.

[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] *Computer Systems* (Systemy komputerowe) – SYKO); 45 h/sem; Tomasz Jamrógiewicz

[Edu17] *Construction of High Quality Audio Equipment* (Konstrukcja urządzeń audio wysokiej jakości – KUA); 30 h/sem.; G. Makarewicz.

[Edu18] *Detection of Nuclear and Biomedical Signals* (Detekcja sygnałów biomedycznych i jądrowych – DSBJ); 60 h/sem.; J. Marzec.

[Edu19] *Digital Cellular Systems* (Cyfrowe systemy komórkowe – CSK); 45 h/sem.; J. Kołakowski.

[Edu20] *Digital Circuits* – EDC1; 60 h/sem.; P. Miazga (English-medium studies).

[Edu21] *Digital Communications* – EDICO; 60 h/sem.; P. Bilski (English-medium studies).

[Edu22] *Diploma Seminar for Undergraduate Students* (Seminarium dyplomowe inżynierskie – SDI); 30 h/sem.; P. Brzeski, W. Gwarek, J. Marzec, Y. Yashchyshyn, J. Żera.

[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] *Fast Massively Parallel Computing Methods* (Szybkie masywnie równoległe metody obliczeniowe – SMOR); 60 h/sem.; J. Naruniec, M. Sypniewski.

[Edu28] *Fields and Waves* (Pola i fale – POFA); 60 h/sem.; W. Gwarek, B. Salski.

[Edu29] *Influence of Electromagnetic Waves on Living Organisms* (Oddziaływanie fal elektromagnetycznych na organizmy żywe – OFE); 30 h/sem.; K. Derzakowski.

[Edu30] *Introduction to Numerical Methods* (Wstęp do metod numerycznych – WNUM); 45 h/sem.; R. Z. Morawski, A. Miękina, A. Podgórski.

[Edu31] *Introduction to Medical Science* (Wprowadzenie do nauk medycznych – WNM); 45 h/sem.; K. Szopiński.

[Edu32] *Measurement Systems* (Systemy pomiarowe – SPOM); 60 h/sem.; W. Winiecki.

[Edu33] *Medical Electronic Instrumentation* (Elektroniczna aparatura medyczna – EAME); 60 h/sem.; R. Szabatin, T. Jamrógiewicz, E. Piątkowska-Janko.

[Edu34] *Microwave Technique (*Technika mikrofalowa – TMO); 45 h/sem.; W. Wojtasiak.

[Edu35] *Multi-service and Multimedia Networks* – EMSMN; 60 h/sem.; T. Keller (English--medium studies).

[Edu36] *Musical Acoustics* (Akustyka muzyczna – AM); 30 h/sem.; J. Żera.

[Edu37] *Nuclear Medicine Techniques* (Techniki medycyny nuklearnej – TMENU); 30 h/ sem.; R. Szabatin.

[Edu38] *Numerical Methods* (Metody numeryczne – MNUB); 45 h/sem.; R. Z. Morawski, A. Miękina, A. Podgórski.

[Edu39] *Numerical Methods* – ENUME; 60 h/sem.; R. Z. Morawski, A. Miękina, A. Podgórski (English-medium studies).

[Edu40] *Object-oriented Programming M* (Programowanie obiektowe M – PROE); 60 h/sem.; J. Naruniec.

[Edu41] *Object-oriented Programming of Multimedia Applications in Java (*Java – obiektowe programowanie aplikacji multimedialnych – OPA); 45 h/sem.; K. Ignasiak.

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

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

[Edu44] *Programming of Geoinformation Applications* (Programowanie aplikacji geoinformacyjnych); 30 /sem.; K. Ignasiak (for Faculty of Geodesy and Cartography)

[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] *Technique of a Radio Receiving* (Technika odbioru radiowego - TOR); 60 h/sem.; W. Kazubski.

[Edu60] *Television Systems* (Systemy telewizyjne – SYTE); 45 h/sem.; A. Buchowicz, M. Rusin.

[Edu61] *Ultrasonography Instrumentation* (Aparatura ultrasonograficzna – AUS); 30 h/sem.; R. Jóźwiak.

[Edu62] *UMTS System (System UMTS – UMTS);* 45 h/sem.; J. Kołakowski.

[Edu63] *Visualization and Modeling in Multimedia* (Wizualizacja i modelowanie w multimerdiach – WIM); 45 h/sem.; W. Skarbek.

3.1.2. Advanced courses

[Edu64] *Adaptive Image Recognition* – EADIR; 60 h/sem.; W. Skarbek.

[Edu65] *Computed Tomography* (Tomografia komputerowa – TOM); 60 h/sem.; W. Smolik.

[Edu66] *Computer - Aided Medical Image Diagnostics* (Komputerowe wspomaganie obrazowej diagnostyki medycznej – KWOD); 45 h/sem.; A. Przelaskowski.

[Edu67] *Computional Electromagnetics for Telecommunications* – ECOET; 60 h/sem.; W. Gwarek, A. Więckowski (English-medium studies).

[Edu68] *Contemporary Heuristic Techniques* (Współczesne techniki heurystyczne – WMH); 60 h/sem.; P. Bilski.

[Edu69] *Data Compression* (Kompresja danych – KODA); 45 h/sem.; G. Galiński, G. Pastuszak.

[Edu70] *Design of Radiocommunication Systems* (Projektowanie układów radiokomunikacyjnych – PSRD); 60 h/sem.; T. Kosiło.

[Edu71] *Digital Audio Signal Processing* (Cyfrowe przetwarzanie sygnałów fonicznych – CPSF); 45 h/sem.; Z. Kulka

[Edu72] *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

[Edu73] *Diploma Seminar for Graduate Students 2* (Seminarium dyplomowe magisterskie 2 – SDM2); 30 h/sem.; J. Marzec, J. Modelski, K. Zaremba, J. Żera.

[Edu74] *Distributed Measurement and Control Systems* (Rozproszone systemy pomiarowo-kontrolne – RSPK); 45 h/sem.; W. Winiecki, R. Łukaszewski.

[Edu75] *Electromagnetic Compatibility* (Kompatybilność elektromagnetyczna – KE); 30 h/sem.; P. Kopyt.

[Edu76] *Evolutionary Algorithms* – EEVAL; 60 h/sem.; P. Miazga (English-medium studies).

[Edu77] *Graphs and Networks* (Grafy i sieci – GIS); 60 h/sem.; S. Kozłowski.

[Edu78] *Hearing and Sound Perception* (Słyszenie i percepcja dźwięku – SPD); 45 h/sem.; J. Żera.

[Edu79] *Image and Audio Semantic Analysis* (Analiza semantyczna dźwięku i obrazu – ASOD); 45 h/sem.; J. Naruniec.

[Edu80] *Informatics Systems in Medicine* (Systemy informatyczne w medycynie – SIM); 45 h/sem.; W. Smolik.

[Edu81] *Large-scale Measurement Methods in Molecular Biology* (Wielkoskalowe metody pomiarowe w biologii molekularnej – MPB); 45 h/sem; T. Rubel.

[Edu82] *Magnetic Resonance Imaging* (Tomografia rezonansu magnetycznego – TRM); 45 h/sem.; P. Bogorodzki.

[Edu83] *Mathematics in Multimedia* (Matematyka w multimediach – MATMU); 60 h/sem.; W. Skarbek.

[Edu84] *Methodological and Ethical Aspects of Research* – EMAR); 45 h/sem.; R. Z. Morawski.

[Edu85] *Modern Radio Transmission Techniques* (Nowe techniki transmisji radiowej – NTTR); 45 h/sem.; S. Kozłowski.

[Edu86] *Neural Networks in Biomedical Applications* (Sieci neuronowe w zastosowaniach biomedycznych – SNB); 45 h/sem., K. Zaremba.

[Edu87] *Noise and Electromagnetic Interference in Electronic Devices* (Szumy i zakłócenia w aparaturze elektronicznej – SZAE); 45 h/sem., J. Marzec.

[Edu88] *Nuclear Medicine Techniques* (Techniki medycyny nuklearnej – TMN); 60 h/sem.; R. Szabatin.

[Edu89] *Radio Localization and Identification Systems* (Radiowe systemy lokalizacji i identyfikacji – RADS); 45 h/sem.; P. Bajurko.

[Edu90] *Satellite Telecommunications* (Telekomunikacja Satelitarna); 30 h/sem.; K. Kurek (for Faculty of Power and Aeronautical Engineering).

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

[Edu95] *Basics of Logical Circuits and Microprocessor Technique* (Układy logiczne i podstawy techniki mikroprocesorowej – PULM); 60 h/sem.; semester 4; B. Konarzewski.

[Edu96] *Basics of Satellite Communications* (Podstawy łączności satelitarnej – SATM); 30 h/sem.; semester 4; J. Modelski.

[Edu97] *Broadcasting systems* (Systemy radiodyfuzyjne – SRDM); 60 h/sem.; semester 6; A. Buchowicz, H. Chaciński.

[Edu98] *Circuits and Signals* (Obwody i sygnały – OSRM); 45 h/sem.; semester 2; J. Cichocki.

[Edu99] *Computer Control and Data Processing* (Komputerowe sterowanie i przetwarzanie danych – KSTM); 45 h/sem.; semester 4, W. Winiecki.

[Edu100] *Digital Cellular Systems* (Cyfrowe systemy komórkowe – CSKM); 36 h/sem.; semester 7; J. Cichocki.

[Edu101] *Digital Signals Transmission* (Cyfrowa transmisja sygnałów – CTSM); 45 h/sem.; semester 5; T. Kosiło.

[Edu102] *Diploma Seminar 1* (Seminarium dyplomowe – SDM); 15 h/sem.; semester 7; J. Cichocki.

[Edu103] *Diploma Seminar 2* Seminarium dyplomowe – SD2M); 30 h/sem.; semester 8; J. Cichocki.

[Edu104] *Electronic Circuits* (Układy elektroniczne – UEM); 45 h/sem.; semester 3; D. Gryglewski.

[Edu105] *Elements of Material Culture* (Elementy kultury materialnej – EKM); 15 h/sem.; W. Brzeziński.

[Edu106] *Ergonomics and Safety* (Ergonomia i bezpieczeństwo pracy – EBPZ); 30 h/sem.; semester 8; L. Kryst.

[Edu107] *Fields and Waves* (Pola i fale – PFM); 60 h/sem.; semester 2; D. Rosołowski.

[Edu108] *Information and Knowledge Society* (Społeczeństwo informacji i wiedzy - SWM) 15 h/sem.; semester 8; P. Stacewicz

[Edu109] *Internet Techniques* (Techniki Internetowe – TINM), 30 h/sem.; semester 7; K. Ignasiak.

[Edu110] *Introduction to Programming* (Wstęp do programowania – WPRM); 15 h/sem.; semester 2; R. Kurjata.

[Edu111] *Mathematics 2* (Matematyka 2 – MAT2M); 90 h/sem.; A. Zapart.

[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); 45 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; W. Kazubski.

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

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

[Edu127] *Basics of Sound Technique* (Podstawy techniki dźwiękowej); 30 h/sem.; Z. Kulka.

[Edu128] *Systems and Devices of Sound Technique* (Urządzenia i systemy techniki dźwiękowej); 30 h/sem.; Z. Kulka.

3.3. International co-operation

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

- Chimie ParisTech (1 person);
- Czech Technical University in Prague (1 person);
- École des Mines de Paris, Paris, France (2 persons);
- Ecole Nationale Supérieure de Techniques Avancées (2 persons);
- École Supérieure de Physique et de Chimie Industrielle, Paris, France (1 person);
- Institut d'Optique Graduate School, Paris, France (1 person);
- Instituto Superior Técnico (2 person);
- Katholieke Universiteit Leuven, Leuven, Belgium (26 persons);
- Norvegian University of Science and Technology (1 person);
- Politecnico di Milano, Milano, Italy (2 persons);
- Technische Universiteit Delft, Delft, The Netherlands (6 persons);
- Technische Universität München, München, Germany (4 persons);
- Telecom ParisTech (1 persons);
- Politechnika Warszawska (4 persons).

3.4. Summer schools

[Edu129] **R. Z. Morawski**: "Inverse problems in measurement science", a lecture delivered during the *LVI School of Mathematics for Dummies* (LVI Szkoła Matematyki Poglądowej) (Wola Ducka, Poland, Aug. 25-29, 2017).

[Edu130] **E. Piątkowska-Janko**: „Searching for structural and functional connections in the human brain", a lecture delivered during the *LVI School of Mathematics for Dummies* (LVI Szkoła Matematyki Poglądowej) (Wola Ducka, Poland, Aug. 25-29, 2017).

[Edu131] **Y. Yashchyshyn:** "4-D antennas for smart beamforming", a lecture delivered during *International Traveling Summer School* (Stockholm, Sweden, Jul. 8-15, 2017).

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 Autónoma 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
Horizon 2020, EU Framework Programme **for** Innovative Training Networks.

The project is realized in the frame of MSCA-ITN-2015-ETN: Marie Skłodowska-Curie Innovative Training Networks.

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] **Precision Technique of Millimeter and sub-THz Band Characterization of Materials for Microelectronics** (Dokładne metody charakteryzacji materiałów dla mikroelektroniki w paśmie fal milimetrowych I subterahercowych).
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", and the Foundation for Polish Science

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 resonat cavities operating in the millimeter and the sub--THz bands. Another such goal is development of a new low-loss yet high dielectric constant material 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 Centre)

4.2.1. International grants

[Pro4] **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 Centre

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 known 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.

[Pro5] **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 Centre

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.

[Pro6] **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 enkapsulowane w kilku warstwach grafenu w molekularnym obrazowaniu MR przeciwnowotworowej terapii opartej na personalizowanej nanomedycynie "czasu rzeczywistego").
Piotr Bogorodzki, E. Piątkowska-Janko, B. Kossowski, J. Orzeł;
Aug. 03, 2015 – Feb. 28, 2018
GEMNS, FP7 ERA-NET EuroNanoMed II
Funded by the National Centre for Research and Development

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.

[Pro7] **Upgrade of the CEDAR Detectors for COMPASS Experiment at CERN** (Modernizacja zespołu detektorów CEDAR w eksperymencie COMPASS w CERN).
Krzysztof Zaremba, J. Marzec, M. Dziewiecki, G. Domański, B. Konarzewski, R. Kurjata, M. Ziembicki, A. Rychter, P. Płoński;
OPUS, International project realized in collaboration with the Andrzej Soltan Institute for Nuclear Studies and Faculty of Physics, Warsaw University;
Jul. 28, 2017 – Jul. 27, 2018
Funded by the National Science Centre

The goal of this project is to upgrade the Cherenkov Differential counters with Achromatic Ring Focus type N (CEDAR) used in beam line of the COMPASS experiment at CERN. Their function is to separate and time-tag different particle types (pions, kaons, antiprotons). The upgrade is necessary to allow for working with a high intensity beams with particle rates of up to 10^8 pps. Another goal is to alleviate the flaws of the original design of the CEDARs (late 70s last century, detectors are in continuous operation from 80s). Three main problems were identified: (A) original electronics design limits acceptable rates to 10^7, (B) detector, lack of beam-independent means of monitoring of photomultipliers (PMTs) stability and efficiency, (C) detectors manifest problems with thermal management (temperature stability and its equality along vessel are a main operating parameter as particle selection is directly coupled with the gas pressure to temperature ratio). Furthermore, gas leaks were detected.

[Pro8] **Indoor and Outdoor NITIC Supported System for Dementia Challenges** (System wsparcia osób z zaburzeniami funkcji poznawczych w środowisku domowym i poza domem).
Jerzy Kołakowski, R. Michnowski, J. Cichocki, M. Kołakowski, V. Djaja-Jośko;
Oct. 01, 2017 – Mar. 31, 2020
IONIS, **AAL Joint Programme**
Funded by the National Centre for Research and Development

The IONIS project is realized in frame with the EU AAL (Active and Assisted Living Programme) addresses precisely these aspects starting from the current situation, designing and building a holistic platform that is expandable. IONIS also brings in several suitable services for elderly and people with mental diseases.

4.2.3. Polish-Norwegian Research Programme, Bilateral Research Cooperation – Preliminary Preparatory Visits from the Warsaw University of Technology (WUT)

[Pro9] **Wiesław Winiecki**, A. Miękina, P. Mazurek, J. Wagner;
Sept. 18, 2017-, Sept. 22, 2017
international project completed in collaboration with the Center for Care Research, Western Norway University of Applied Sciences (WNUAS), Bergen, Norway.
Funded by the National Centre for Research and Development

The main aim of this project was to tighten the cooperation between the researchers from WUT and WNUAS, and to prepare a joint application for research funding from the Regional Research Funds in Norway – institution linked to the Norwegian Council for Research. The title of the research application is "Safer at home. An investigation of enhanced monitoring technology for frail elderly and disabled people living at home", while the research plan comprises: series of lectures to be given to the elderly persons, on the emerging monitoring techniques and their capabilities; survey on the attitude of the elderly persons towards impulse-radar-sensor based and depth-sensor based monitoring; installation of the sensors in a flat of a person living alone, and acquisition of an extensive data set designed for further development of systems for monitoring of elderly persons in their living environment.

[Pro10] **Waldemar Smolik**, J. Kryszyn, D. Wanta;
Sept. 11 – Sept. 15, 2017
EVT4 Action, international project realized in collaboration and University College of Southeast Norway, Faculty of Technology, Natural Sciences and Maritime Science.
Funded by the National Centre for Research and Development

As a part of EVT4 Activity, a visit to the University College of Southeast Norway (USN) was held. USN is the second largest state university in Norway, measured in the number of students. The importance of this potential research partner raises from the fact of its broad cooperation with industry. Representatives of the research team from the Institute of Radioelectronics and Multimedia Technology Warsaw University of Technology (WUT) were welcomed by Professor Kanabasabapath Mylvaganam. The aim of the visit was to present the research team from WUT and its achievements to the Norwegian side. Lectures on electrical capacitance tomography were delivered, including "Electrical capacitance tomography - the fundamentals" and reports on current research. Presentation of EVT4 electrical capacitance tomography system developed at the Institute of Radioelectronics and Multimedia Technology WUT was made. Visiting the USN laboratories allowed to recognize the scope of research conducted by the Norwegian side. Possible areas of cooperation with the Polish side, including the potential applications of capacitance tomography, gamma-ray or ultrasound imaging in research work conducted by USN researchers, were identified. A joint application for a grant under the EOS program on the development and applications of electrical capacitance tomography was planned.

4.2.4. 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 Centre

The main goal of this project was 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, considering 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 was crucial for effective design of future experiments this area of knowledge. As a tool for conducting such analyzes, it was 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, D. Rosołowski, P. Korpas;
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, considering the limitations of raster scanning antenna radiating elements in a wide.

[Pro13] **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, K. Godziszewski, P. Piasecki, J. Sobolewski, 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 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, transmis-

sion 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 around design and manufacturing of modern millimeter-waves systems.

[Pro14] **Sub-THz Active 3D Scanner for Countererrorism Purposes** (Aktywny sub-THz skaner 3D do zastosowań antyterrorystycznych).
Yevhen Yashchyshyn, P. Bajurko, S. Kozłowski, G. Bogdan, K. Godziszewski;
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.

[Pro15] **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 Centre

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.

[Pro16] **Electromagnetic Method of Estimating the Degree of Penetration in the Process of Proppant Fracturing** (Metoda elektromagnetyczna estymacji stopnia penetracji propantu w procesie szczelinowania).
Przemysław Miazga;
EMPROP, Blue Gas Program
Dec. 01, 2014 – Nov. 30, 2017
Funded by the National Centre for Research and Development

The project was aimed at verification of using magnetic proppants for characterization of propped fractures which resulted from hydraulic fracturing. The idea was to perform magnetotelluric (MT) measurements on various stage of this process. The project would verify if the magnetic proppant is change the measurements in such way that the differential image would provide information about the volume or dimensions fractures. The project was carried out at PGNiG, AGH University of Science and Technology, Gdańsk University of Technology, the Institute of Electronic Systems, WUT, the Institute of Ceramics and Building Materials. The project would involve interdisciplinary research in geophysics, materials science, electronics and information science. Expected major outputs of the project were: 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.

[Pro17] **Methods of Protection and Defense Against the HPM Impulses** (Metody i sposoby ochrony i obrony przed impulsami HPM).
Paweł Kopyt, B. Salski;
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. Because 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 Defense for absorbers, as well as user security communication equipment, radar equipment, and manned and unmanned facilities and platforms.

[Pro18] **Microwave Stun Weapon** (Mikrofalowa broń obezwładniająca).
Piotr Bogorodzki, Y. Yashchyshyn, E. Piątkowska–Janko, G. Domański, K. Godziszewski, M. Wieteska.
Dec. 30, 2014 – Dec. 29, 2023

Funded by the National Centre for Research and Development

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.

4.2.4. Grants for young researchers

[Pro19] **Modeling and Optimization of Four Wave Mixing in Microstructured Optical Fibers for Terahertz Radiation Generation** (Modelowanie i optymalizacja mieszania czterofalowego w mikrostrukturalnych włóknach światłowodowych na potrzeby generacji promieniowania terahercowego).
Adam Pacewicz, B. Salski;
Jul. 11, 2017 – Oct. 11, 2019
Diamond Grant
Funded by the Ministry of Science and Higher Education

Trahertz radiation has a great potential to be more widely applied and commercialized in areas such a spectroscopy, imaging, and telecommunications. A promising method of terahertz radiation generation is utilizing nonlinear optical effects, first and foremost four-wave mixing, arising in microstructured optical fibers pumped by laser pulses. The main goal of the project is electromagnetic numerical modeling of radiation generation using a newly proposed method formulated in the time domain. Moreover, both theoretical and experimental work on the implementation of a fiber in which effect radiation generation can occur will be undertaken, taking available technological capabilites into account.

[Pro20] **Preparations for the Construction and Testing of an Overhead Radio Transmitter Working in the VLF Band and Television Systems Operating in the High Energy Spectrum** (Przygotowania do konstrukcji i badań napowietrznego nadajnika radiowego pracującego w paśmie VLF oraz systemów telewizyjnych pracujących w widmie wysokoenergetycznym).
Tomasz A. Miś, J. Modelski;
Mar. 23, 2017 – Sept. 30, 2018
'Best of the Best' Conceptual Program Funded by the Ministry of Science and Higher Education in scope of EU Knowledge, Education, and Development Program

The purpose of this project is to participate in scientific conferences devoted to radiotechnology and radiocommunications for the purpose of presenting a doctoral project designing and using a mobile overhead transmitter working in the VLF band (very long wavelengths), and research and experimental results at Mars Desert Research Station, Utah, USA. Designed and built innovative television technology devices – cameras capable of processing moving images in high energy spectra. The project also includes training visits to world-renowned radiotechnical centers in the field of ultra-long wave communication techniques, aimed at increasing the value of a doctoral dissertation by performing detailed technical discernment.

4.3 Projects granted by the University

4.4.1 Statutory projects

[Pro21] **Microwave and Optoelectronic Devices Design Using Electromagnetic Modelling with account of the Coupled Physical Effects** (Projektowanie urządzeń mikrofalowych i optoelektronicznych wspomagane modelowaniem pól elektromagnetycznych z uwzględnieniem sprzężonych zjawisk fizycznych).
Wojciech Wojtasiak, S. Rosłoniec, B. Salski, M. Celuch, D. Rosołowski, D. Gryglewski, P. Kopyt, P. Korpas, P. Miazga, M. Sypniewski, M. Krysicki, M. Góralczyk, D. Kuchta, T. Karpisz, M. Lubiejewski;
Apr. 11, 2016 – Nov. 30, 2017

Research has been conducted in various scientific fields, including measurements of ferromagnetic materials, modeling of quantum cascade lasers, and development of broadband and resonant systems for characterization of materials in microwave and mm-wave bands. The team continued the work on development of new high-power and high efficiency GaN HEMT amplifiers. Important part of the work was devoted to design GaN HEMT structure topology as well as characterization of fabricated transistors in the frame cooperation with IWC PAN, ITE and Ammono.

[Pro22] **Audiovisual Networked Hybrid Systems** (Inteligentne, sieciowe systemy wielokamerowe).
Krystian Ignasiak, W. Skarbek, G. Pastuszak A. Buchowicz, G. Galiński, J. Naruniec, A. Abramowski, M. Trochimiuk, G. Gwardys, D. Grzywczak, M. Kowalski;
Apr. 11, 2016 – Nov. 30, 2017

Intelligent, distributed, network multi-camera systems are an important class of multimedia systems. They play a key role in the research and teaching of the Television Division. Conducted as part of the statutory work, scientific and research activity covered all the above aspects. The work included the camera's nonlinearity calibration using variant of Gauss model based on structured light technique. A detailed analysis of existing imaging systems using the omnidirectional cameras creating a 3D image was carried out, and then on this basis, the own player module of such multi-camera video sequences enriched with virtual elements was designed and implemented on the mobile device. As part of the work, an algorithm for locating specific facial points using deep, convolutional neural networks was also proposed. The proposed algorithms are characterized by state-of-the-art performance and at the time of publication were the most accurate algorithm for locating specific points in real

time. The solution won the third place at the workshop of the prestigious CVPR2017 (Computer Vision and Pattern Recognition) conference. (4) A universal system of editing didactic digital media presentation in web browsers was designed and implemented with the possibility of creating a tree of multimedia units, including literate programming units, all within Wiki pages.

[Pro23] **Application of Odometry Technique for Radio Positioning Systems Evaluation** (Wykorzystanie metod odometrycznych do weryfikacji właściwości systemów radiolokalizacyjnych).
Jerzy Kołakowski, J. Cichocki, R. Michnowski, K. Radecki, V. Djaja-Jośko, M. Kołakowski;
Apr. 11, 2016 – Nov. 30, 2017

The project consisted in development of an odometry system intended for radio positioning systems verification. The system embedded into a trolley includes two encoders and measurement wheels allowing for recording of passed distance with 1 cm resolution. Encoders' data are recorded with ARM microcontroller system. Measurement results are transferred to the PC and processed with the developed algorithm. The software allows for reduction of measurement errors introduced by mechanical setup imperfections and determination of passed route. The system allows for tracking moving trolley with error lower than several centimeters.

[Pro24] **New Transmission Techniques in Satellite Systems** (Nowe techniki transmisji w systemach satelitarnych).
Józef Modelski, K. Kurek, T. Truszczyński;
Apr. 11, 2016 – Nov. 30, 2017

The aim of the project was an analysis of possible use of new transmission techniques in satellite communication. New modulation, channel coding and adaptive transmission techniques, that allow to maximize total amount of data transmitted by the satellite, have been considered in the project.

[Pro25] **Optimisation of Class E Resonant Amplifiers in the Frequency Range 10-100 MHz** (Optymalizacja układów i konstrukcji rezonansowych wzmacniaczy mocy klasy E o częstotliwościach roboczych w zakresie 10MHz – 100 MHz).
Mirosław Mikołajewski, H. Chaciński, W. Kazubski, J. Modzelewski;
Apr. 11, 2016 – Nov. 30, 2017

Research project concerned optimisation of transistor-switch gate drivers and resonant output circuits in Class E amplifiers operating in the frequency range 10-100 MHz. Simulations and experimental results have shown that the MOSFET switch gate-to-drain capacitance effectively prevents the amplifier switch to operate in truly zero-voltage switching conditions. This leads to optimum driving conditions of the transistor switch which ensure both limited gate drive power and reduced switching losses in the transistor. Optimised topologies of amplifier output circuits have also been proposed. Theoretical results have been verified experimentally by designing and building Class E amplifiers with MOSFET transistor switches made in various technologies. Finally, as an example of Class E amplifier application an induction heater with the amplifier was built for the heat treatment of nitinol wires in the temperature range 500-700 centigrade for the surgery use. Obtained research results have shown that the proposed solutions can be applied to small-size high-efficiency industrial instrumentation as well as radio-transmitters.

[Pro26] **Interpretation of Empirical Data and its Meta-Metrological Context** (Interpretacja danych empirycznych i jej kontekst metanaukowy).
Roman Z. Morawski, A. Miękina, A. Podgórski;
Apr. 11, 2016 – Nov. 30, 2017

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 is a viable alternative to the techniques based on visual cameras and wearable devices. It enables non-invasive measurements of parameters of both human body movements and selected bodily functions. The results of the project include: several new methods and algorithms for processing data from radar sensors, depth sensors and accelerometric sensors, dedicated to monitoring of elderly and disabled persons. Those results have been partially published in a JCR journal paper and in seven conference papers.

[Pro27] **Signal Processing Algorithms in Radiocommunication Systems - Theoretical Studies and Computer Simulations** (Analizy teoretyczne i symulacje komputerowe algorytmów przetwarzania sygnałów w systemach radiokomunikacyjnych).
Kajetana Snopek, T. Kosiło, S. Kozłowski, Ł. Błaszczyk;
Apr. 11, 2016 – Nov. 30, 2017

The research was carried out in three different fields: hypercomplex signal processing, in-door localization and Soft Defined Radio systems. The novel theoretical results in the domain of quaternion compressed sensing and octonion frequency analysis were obtained and published. Some interesting practical experiments concerning Beacon Low Energy localization were performed and different methods of smartphone-beacon distance calculation were tested. Additionally, as a part of the work an experimental system consisting of an SDR module, a personal computer and dedicated software was set up to enable the reception and recording of wideband radio signals.

[Pro28] **Development of Algorithms and Devices for Monitoring and Diagnostics of Electrical Devices and Analog Systems** (Rozwój algorytmów i urządzeń do monitoringu i diagnostyki urządzeń elektrycznych i systemów analogowych).
Wiesław Winiecki, P. Bilski, R. Łukaszewski, K. Mroczek, A. Wójcik, K. Dowalla;
Apr. 11, 2016 – Nov. 30, 2017

Methods for the non-invasive monitoring of electrical appliances based on the selected parameters and features acquired from current and voltage measurements were proposed. The method for the anonymous monitoring of human life functions with the ability to perform measurements through the building walls. The set of algorithms including self-organizing maps, RBF neural networks and random forests for

the diagnostics of analog systems, questionnaire analysis and investment strategies was proposed.
A group of measurement and measurement and control systems using the advanced hardware and software with the modern architecture. 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.

[Pro29] **Investigation of Time Modulated Antenna Arrays** (Badanie anten z modulacją czasową).
Yevhen Yashchyshyn, P. Bajurko K. Derzakowski, K. Godziszewski, G. Bogdan, D. Nyzovets, P. Piasecki, J. Sobolewski;
Apr. 11, 2016 – Nov. 30, 2017

The aim of this work was to develop a low-cost beam-forming antenna array for the X-band and to compare two methods of beam scanning: a phased array approach and a time modulation approach. The antenna structure was composed of individually fabricated linear sub-arrays suspended over the ground plane. Each sub-array was excited through a separate coaxial connector, therefore beam scanning could be achieved by controlling radio frequency (RF) signals in each sub-array. Efficiency of the time modulated antenna array (TMAA) was estimated using theoretrical analysis as well as measurements of an RF switch. Moreover, the performance of the TMAA was confirmed by measurements in an anechoic chamber.

[Pro30] **Advanced Techniques in Nuclear and Medical Electronics** (Zaawansowane techniki elektroniki jądrowej i medycznej).
J. Marzec K. Zaremba, P. Bogorodzki, P. Brzeski, G. Domański, M. Dziewiecki, T. Jamrógiewicz, B. Konarzewski, R. Kurjata, 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, M. Stosio, D. Wanta, K. Werys, M. Wieteska, P. Wróblewski, P. Tor;
Apr. 11, 2016 – Nov. 30, 2017

Study of enhancement of Nuclear Magnetic Resonance (NMR) signal in aqueous solutions with the use of Remotely Enhanced Liquids for Image Contrast (RELIC) technique

The aim of the study was to create the experimental setup and conduct research on enhancing the proton NMR signal through RELIC technique. Signal enhancement factor was measured in aqueous solution of TEMPOL radical as a function of flow speed and microwave power. The solution with free radical was placed inside a syringe. Flow was maintained by a remotely controlled syringe pump. Electrons were irradiated with microwaves inside a TE011 cavity resonator. The level on NMR signal was measured when the solution reached the custom-built NMR coil. Enhancement of NMR signal was observed, maximum enhancement factor of E=10 was achieved.

Study of dead time of an X-ray and gamma-ray detector

The purpose of this work was to analyze various factors that contribute to the dead time of an X-rat or gamma-ray detector. The dead time is one of crucial parameters of this type of detectors, as it affects maximum rate at which ionizing radiation can be probed. The work comprises an introduction to the theory of dead time estimation using a two-source method, followed by measurements and analysis of uncertainties. The results showed that there exist an optimum ratio of the measurement times between the two sources for a non-paralyzable detector.

Data acquisition system for electrical capacitance tomography

The work carried out in this year was a continuation of the research on electric capacitance tomography, which was started in previous years. The hardware of the data acquisition system for electrical capacitance tomography was developed. Two prototypes of the EVT4 tomographic system were built.
As part of the task for the year 2016/17, the architecture of the embedded software for the EVT4 data acquisition system and user software was developed. Embedded (system) software was written in VHDL, PicoBlaze processor assembler, and C language. The user software for Windows system was developed in C++/CLI. The developed software enabled the first measurements using the EVT4 tomographic system.

[Pro31] **New Methods for Testing Sound Processing Quality** (Nowe metody badania jakości przetwarzania dźwięku).
Jan Żera, P. Bilski, G. Makarewicz, A. Pietrzak, M. Lewandowski, P. Bobiński;
Apr. 11, 2016 – Nov. 30, 2017

The study comprised three research projects. The purpose of the first project was to assess the similarity of music pieces by means of an acoustic feature analysis. A number of features were designed or selected in the frequency-time domain and assessed with the nearest k-neighbor and neural network classifiers. The system was tested with the participation of potential users. The second project was dedicated to the development of a method based on the grey systems theory (GST), intended for active compensation of distortion and noise interference in audio signal limiters and compressors. The GST-based method can also be implemented in active noise reduction systems. The third project was a study of noise exposure among musicians. The measurements were made within the community of university music students, with the use of two-channel noise dosimetry. The daily noise exposure levels were measured for musicians playing a flute, a clarinet, a trumpet and a trombone with special focus on solo playing and playing in a large orchestra. It was found that the amount of sound exposure, measured for an individual musician, depends on his/her location within the orchestra. The use of two-channel dosimetry enabled to study the asymmetry of noise exposure between the left and the right ear.

4.3.2. Projects granted by the Rector

[Pro32] **Multi-Channel System of Acquisition and Processing of Bioelectric Signals** (Wielokanałowy system akwizycji i przetwarzania sygnałów bioelektrycznych).
Grzegorz Domański, R Plucińska, K. Walędzik, J. Majdecki;
May 31, 2017 – Dec. 31, 2017

The aim of the project was to construct a multichannel system of acquisition and processing of bioelectric signals. The system consists of several specialized measuring electrodes, a bioelectric signal amplifier, an analog-digital conversion circuit, a control

system and a wireless transmission system. The developed program with a graphical user interface was used for acquisition and visualization of waveforms. Pre-processing and filtration is provided by developed software for processing of collected biological signals.

[Pro33] **Realization of Mobile Ground Station for Reception of APRS Data from Stratospheric Balloons** (Budowa mobilnej stacji naziemnej do odbioru danych APRS z balonów stratosferycznych).
Krzysztof Kurek
May 31, 2017 – Dec. 31, 2017

The aim of the project was realization of a mobile ground station for communication with stratospheric balloons in radio amateurs' frequency bands. The station consists of a rotor with antennas and a radio receiver. The rotor is controlled by PC computer allowing to change antennas orientation in azimuth and elevation planes can be mounted on a tripod or a car roof. The receiver is realized using software defined radio (SDR) module and band pass filters. Software for reception and decoding of APRS packets has been created.

4.3.3. Projects granted by the Dean

[Pro34] **Wireless Video Data Transmission to Virtual Reality Headset** (Bezprzewodowa transmisja danych wideo do hełmów wirtualnej rzeczywistości (VR)).
Przemysław Korpas;
May 16, 2017 – Dec. 31, 2017

The aim of this work was to prepare a design of a wireless video and audio link which would replace HDMI cable in a connection between the virtual reality headset and a PC computer. The main challenge was to pass the requirement of low latency (below 4 ms) and limited available RF bandwidth while keeping picture resolution 2160x1200 @ 90Hz and high level of perceived quality. A few concepts have been analysed and the final solution is proposed.

[Pro35] **Convolutionary Neural Networks with Dynamic Architecture Selection** (Konwolucyjne sieci neuronowe z dynamicznym doborem architektury).
Piotr Płoński;
May 16, 2017 – Dec. 31, 2017

The aim of the project was development of algorithm for automatic size adjustment for artificial neural networks and development of methods for automatic feature generation.

[Pro36] **Investigation of Spectral Characteristics of New Types of SIPM Detectors** (Badanie charakterystyki widmowej nowych typów półprzewodnikowych detektorów światła z Geigerowskim powielaniem elektronowym).
Andrzej Rychter;
May 16, 2017 – Dec. 31, 2017

The aim of the project was to develop the measurement system and measure the spectral characteristics of new types of SIPM detectors (Silicon photomultipliers) - multi-pixel avalanche photodiodes (MAPD). The existing measurement stand has been equipped with a PX-2 pulsed xenon lamp for the ultraviolet and manual DMC1-02 mini-monochromator where the wavelength can be selected and read to 0.2 nm within a range from 200 to 800 nm. New types of SIPM detectors from Sensl and Ketek have been purchased. Measurements of spectral characteristics for different types of SIPM detectors has been performed.

4.4. Other projects

[Pro37] **Expert Services 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.

[Pro38] **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 To mograph), 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.

[Pro39] **28-GHz Reconfigurable Beamforming Antenna Based on PIN Diodes** (28-GHz konfiguracja kształtowania wiązki oparta na diodach PIN).
Yevhen Yashchyshyn, K. Derzakowski, G. Bogdan, K. Godziszewski;
Aug. 01, 2016 – Jan. 31, 2017
Funded by Electronics and Telecommunications Research Institute, Republic of Korea (Instytut Elektroniki i Telekomunikacji Republiki Korei).

A concept of a reconfigurable antenna was based on a reconfigurable slot aperture, which was placed instead of a narrow wall of a metallic rectangular waveguide. A standard rectangular waveguide WR-28 had been used. Reconfigurable slot aperture was 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 had to be chosen in a special manner in order to provide required direction of the beam.

[Pro40] **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 sp.z.o.o.

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

[Pro41] **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 sp.z.o.o.

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.

[Pro42] **Design and Implementation of HD--Signal-Converters Prototypes** (Opracowanie oraz wykonanie zestawu prototypów przemienników sygnału HD).
Grzegorz Pastuszak;
Oct. 03, 2016 – Dec. 31, 2017
Funded by CAMSAT Gralak Przemysław

The project was focused on the development of signal converters between three types of high definition video analog signals: AHD, TVI and CVI. The result would 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.

[Pro43] **Expertise on Consulting Service for Telecommunication Systems** (Usługi konsultingowe w zakresie audytu systemów telekomunikacyjnych).
Józef Modelski, J. Cichocki, A. Buchowicz, K. Kurek, T. Krzymień, W. Wojtasiak;
Jan. 18, 2017 – Feb. 17, 2017
Funded by EMITEL sp.z.o.o.

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

[Pro44] **Reconfigurable Beamforming Antenna with Semiconductor Switches and Time-Modulated Antenna Array** (Rekonfigurowalna antena z kształtowaniem wiązki na bazie przełączników półprzewodnikowych oraz modulacji czasowej).
Yevhen Yashchyshyn, G. Bogdan, K. Godziszewski;
Jun. 01, 2017 – Nov. 30, 2017
Funded by Electronics and Telecommunications Research Institute, Republic of Korea (Instytut Elektroniki i Telekomunikacji Republiki Korei).

The project was realized between the Warsaw University of Technology, Institute of Radioelectronics and Multimedia Technology, and the 5G Giga Communication Research Laboratory, Electronics and Telecommunications Research Institute (Republic of Korea). The project was aimed to investigate and develop a time modulated antenna array with wider bandwith and higher efficiency than recently has been achieved for this type of antennas.

[Pro45] **Use of the Microwave Measuring Equipment: VNA and Power Meter with the-Testing Instrumentation** (Udostępnienie mikrofalowej aparatury pomiarowej: analizatora sieci, miernika mocy do przeprowadzenia badań i pomiarów)
Wojciech Wojtasiak, D. Gryglewski, P. Korpas, D. Rosołowski;
Feb. 6, 2017 – May 31, 2017 part I
Sept. 01, 2017 – Dec. 31, 2017 part II
Funded by Qwed sp.z.o.o.

The project was carried out at the Microwave and Radiolocation Engineering Division, Institute of Radioelectronics and Multimedia Technology, WUT, and Qwed Ltd. The objective of this project was to develop unique microwave apparatus for precise measurements of electromagnetic properties of materials at microwave frequencies.

[Pro46] **Use of the Equipment with the Testing Instrumentation** (Udostępnienie aparatury badawczej do przeprowadzenia badań rozwojowych).
Wojciech Wojtasiak, D. Gryglewski, P. Korpas, D. Rosołowski;
Jul. 01, 2017 – Nov. 30, 2019
Funded by IT Partners Telco sp.z.o.o.

The aim of this project is to develop a complete measurement setup for dielectric materials. IT Partners Telco Ltd. will participate in the research conducting at the Microwave and Radiolocation Engineering Division, Institute of Radioelectronics and Multimedia Technology. The will be the device able to support modern measurement techniques for very high frequency ranges.

[Pro47] **Research Work on Improving Wireless Sensor Designs** (Prace badawcze przy doskonaleniu projektów sensorów bezprzewodowych).
Paweł Bajurko;
Jul. 24, 2017 – Jan. 15, 2018
Funded by Netemera sp.z.o.o.

The aim of this project is to provide support in the design of wireless sensors.

[Pro48] **Elaboration and Construction Transmitting Antenna and Amplifiers for Noise Demonstrator** (Opracowanie oraz wykonanie anten nadawczych i wzmacniaczy do demonstratora szumowego).
Daniel Gryglewski, W. Wojtasiak, P. Korpas, D. Rosołowski;
Sept. 19, 2017 – Nov. 10, 2017
Funded by the Institute of Electronic Systems, Faculty of Electronics and Information Technology, WUT.

The aim of the project was to design and construct antennas and amplifiers for a noise demonstrator. The project was realized in collaboration between the Institute of Radioelectronics and Multimedia Technology and Institute of Electronic Systems, Warsaw University of Technology.

[Pro49] **Expertise on Radar Cross-Section of Selected Aircrafts** (Opracowanie ekspertyzy dotyczącej skutecznej powierzchni odbicia wybranych konstrukcji lotniczych).
Bartłomiej Salski, P. Kopyt;
Oct. 11, 2017 – Nov. 30, 2017
Funded by AM Technologies sp.z.o.o.
Details of this project cannot be published due to non-disclosure agreement with the contractor.

[Pro50] **Measurement of Environmental Noise in Detached Houses** (Wykonanie pomiarów hałasu środowiskowego w zabudowie jednorodzinnej).
Jan Żera;
Sept. 04, 2017 – Sept. 30, 2017
Funded by Doradztwo Energetyczne Jerzy Majcher sp.z.o.o.

The aim of the project was to perform the measurement of environmental noise in the field of detached houses to avoid the negative impact on the humans.

[Pro51] **Elaboration of an Intelligent Multi--Source Data Analysis System for Monitoring Consumer Bevaviour and Devices for Data Transmission from POS** (Stworzenie inteligentnego systemu analiz danych wielośródłowych służącego do monitorowania zachowań konsumenckich oraz urządzenia do przesyłania danych z systemów POS).
Waldemar Smolik, J. Kryszyn, D. Wanta;
Jun. 19, 2017 – Sept. 20, 2017
Funded by NETRIX Group S.A.

The aim of the project is to develop an innovative system for the analysis of multi-source data, human behavior, business processes of data mining, and as a result, the creation and availability of new improved procedures and solutions. The aim of the project's application is to build a prototype of an information system for analyzing consumer behaviors, optimizing and generating innovative business processes of data mining. Business models would be created based on data from external sources, from data warehouses (including ERP systems) and data from online resources like POS systems (web mining). The development of internet-related technology will be achieved by developing algorithms for searching data in network resources. The main goal of the project is the use of artificial neural networks, statistical methods, stochastic, fuzzy sets and genetic algorithms as well as their various connections for the construction of intelligent computing systems.

[Pro52] **Use of the Anechoic Chamber** (Udostępnienie komory bezechowej).
Jan Żera
Oct. 16, 2017
Funded by Peter Siedlaczek Ltd.

The anechoic chamber located at the Electroacoustics Division belongs to Poland's largest facilities for acoustic measurements in free-field condition. The Peter Siedlaczek Ltd., offers an exteremely versatile inspiring tools for composers, arrangers and producer.

[Pro53] **Acoustic Measurement at the Ignacy Jan Paderewski Pomeranian Philharmonic in Bygdoszcz** (Badania akustyczne Filharmonii Pomorskiej im. Ignacego Jana Paderewskiego w Bydgoszczy).
Jan Żera
Oct. 25, 2017
Funded by Manufaktura Technologiczna sp.z.o.o.

The purpose of the project was to describe the present acoustical conditions in the main Concert Hall and in the Chamber Concert Hall at the Ignacy Jan Paderewski Pomeranian Philharmonic in Bydgoszcz. The specific objective of the work was to obtain a complete set of acoustical measurements according to the PN-EN-ISO 3382-1 standard and provide recommendations for the planned modernization of both halls.

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

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.

4.5.2.2. 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.

CentriX

The new established science and technology platform CentriX is founded by European Regional Operation Fund 2014 – 2020 for Mazowian Voivodeship. This project is carried out at National Center for Nuclear Research, Institute of Radioelectronics and Multimedia Technology with co-operation of Imagine RT Ltd., and Eastern Wall Technologies Ltd. The main goal of this project is to establish the innovation and scientific center and realize researches in the field of industry radiation techniques.

Outstanding industrial project – co-operation with IT Partners Telco Ltd.

The Institute of Radioelectronics and Multimedia Technology (microwave and radiolocation Engineering Division) in collaboration with IT Partners Telco Ltd., realized the project called “Innovative at global level microcell LTE-Advanced working with high RF power in 3.4-3.8 GHz frequency range” founded from EU Innovative Development Operation Program. Institute of Radiolectronics and Multimedia Technology making the equipment available for IT Partners Telco LTd. to conduct the research activities possible through this project.

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 few 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.

4.5.3. Student research groups

Space Engineering Student Research Group

Krzysztof Kurek – tutor.

Space Engineering Student Research 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 Research Group

Grzegorz Domański – tutor.

Biomedical and Nuclear Engineering Student Scientific Group (in Polish: Studenckie Koło Inżynierii Biomedycznej i Jądrowej “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 based 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. KNITI organized courses for students of our university, two courses on basics of C# programming language, and one course on advanced Windows 8 programming for mobile devices. 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.

Radio Localization Student Research Group – LORAD

Jerzy Kołakowski – tutor.

Radio Localization Student Research Group LORAD was established in 2016 at the Warsaw University of Technology. It brings together undergraduate and postgraduate students from Institute of Radioelectronics and Multimedia Technology. LORAD's main field of interest are radio localization systems, especially those intended for indoor localization. LORAD focuses mostly on ultrawideband localization techniques, however it is interested in inertial localization techniques and SLAM systems as well.
Members of the Radio Localization Student Research Group carry out various tasks, starting from PCB design and assembly, through microcontroller and PC applications programming ending with localization algorithms design and implementation. Additionally, unmanned, self-localizing indoor flying and driving vehicles are developed.
In its projects LORAD cooperates with UWB Systems Research group.

Electromagnetic Modelling Student Research Group

Bartłomiej Salski - tutor

Members of the Electromagnetic Modelling Student Research Group have realized the project: "System for characterization of materials at millimeter spectrum". One of the hurdles in the development of devices and systems working in the millimeter-wave band is that the electromagnetic properties of the materials used for their construction should be well known at the design stage. The goal of the project is to develop a practical and portable test-bench for free-space characterization of planar samples in the frequency range 18-40 GHz. Strengths of the chosen characterization method include a broad analysis bandwidth and non-destruction of the sample. It is hoped that students and faculty members will benefit from both building and utilizing the test-bench for research purposes.

3Z5PW Experimental Amateur Radio Station

Dawid Rosołowski – tutor.

The 3Z5PW is the callsign of the amateur radio club station set up in 2015 with the goal of developing interest in RF and microwave technology among students of The Faculty of Electronics and Information Technology and of the whole WUT. Due to the interdisciplinary character of the contemporary amateur radio, the Experimental Station activities focus on the practical use of the knowledge in the field of analog radio electronics - development of components for transceivers, designing simple and more complicated radio circuits and antennas for educational and experimental purposes, as well as applications of SDR technology and uC programming. All efforts allow the club members to make long distance wireless contacts with other stations in faraway places on the HF, VHF and SHF bands in more conscious way.
Current activities are concentrated on education and training of young radio operators (two editions of amateur radio courses), promotion of ham radio and the development of the radio shack. 3Z5PW station operators: Dawid Rosołowski (SQ5JQI), Grzegorz Grochowski (SP5QWG), Przemysław Korpas (SQ7JHV).

4.6. Instrumentation Investments

4.6.1. Centre for Biomedical Technology and Medical Physics

Nuclear and Medical Electronics Division (**Krzysztof Zaremba** – head)
2008 - 2017
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. Panda 2 Project

The Institute of Radioelectronics and Multimedia Technology together with the partners of the CePT Project participates in the implementation of the contract for the execution and financing of the Panda 2 Project, which aims to support the cost of maintaining the readiness of the research infrastructure. The contract was concluded in 2016 with a period of 4 years. According to The National Centre for Research and Development (NCBR) roles the program is aimed at supporting the costs of maintaining R & D infrastructure built or rebuilt thanks to the implementation of projects within the second axis of the Innovative Economy Programme (POIG), for which the final eligible costs was at least 50 million PLN.

4.6.3. Sub-terahertz Technology and Antenna Laboratory

Yevhen Yashchyshyn, P. Bajurko
2010 – 2017
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] Jan Żera – promoted to a professor title (Feb. 27, 2017).

5.2. D.Sc. Degrees

[DSc1] Paweł Kopyt: *"Numeryczne modelowanie elektromagnetyczne komponentów dla mikrofalowych i subterahercowych torów odbiorczych"* (Electromagnetic numerical modeling of components for microwave and sub-terahertz receiving paths), Warsaw, Dec. 19, 2017.

5.3. Ph.D. Degrees

[PhD1] Łukasz Błaszczyk: *"Algebry Cayleya-Dicksona w analizie sygnałów z elementami teorii oszczędnego próbkowania"* (Cayley-Dickson algebras in the signal theory analysis with the elements of compressed sensing), Assoc. Prof. **K. Snopek** (supervisor), in honours, Warsaw, Nov. 21, 2017.

[PhD2] Maciej Trochimiuk: *„Optymalizacja predykcji międzyobrazowej w kodowaniu danych wizyjnych"* (Optimization of inter-prediction in encoding video data), Prof. **G. Pastuszak** (supervisor), Warsaw, Dec. 12, 2017.

5.4. M.Sc. Degrees

[MSc1] Michał Paweł Antosiewicz: *„Wzmacniacz liniowy o mocy ok. 20W na pasmo 26-29 MHz do radiotelefonu CB o niskim poziomie emisji niepożądanych"* (20 W output power linear amplifier for 26-29 MHz frequency band to CB radio set with a low level of unwanted emission), Assist. Prof. **W. Kazubski** (supervisor).

[MSc2] Zuzanna Baranowska: *"Metodyka szacowania dawek w mieszanym polu promieniowania beta i gamma przy zastosowaniu dozymetrów termoluminescencyjnych"* (Methodology of dose estimation in mixed beta gamma radiation field using thermoluminescent dosimeters), Assist. Prof. **P. Tulik** (supervisor).

[MSc3] Ewelina Bartuzi: *"Rozpoznawanie tożsamości z wykorzystaniem obrazów termicznych dłoni"* (Identity recognition based on hand thermal images), Prof. **A. Pacut** (supervisor).

[MSc4] Emilia Bąk: *"Rezonansowa wysokosprawna przetwornica typu front-end"* (High-efficiency front-end resonant power converter), Assist. Prof. **M. Mikołajewski** (supervisor).

[MSc5] Kamil Mateusz Brzóski: *„Dwuwyjściowy modulator fazy w zakresie 0 - 90 stopni i 0 - -90 stopni o dużej symetrii i wysokiej liniowości"* (Two-channel phase modulator in the range of 0 – 90 degrees, and 0 – 90 degrees with high symmetry and high linearity), Assist. Prof. **M. Mikołajewski** (supervisor).

[MSc6] Milena Weronika Budzińska: *„Program do automatyzacji analizy obrazów PET/CT w radioembolizacji guzów wątroby"* (Program for automatic overlapping PET-CT image in liver tumors radioembolization), Assist. Prof. **G. Domański** (supervisor).

[MSc7] Damian Cacko: *"Projekt i weryfikacja eksperymentalnego systemu obrazowania ultradźwiękowego"* (Design and verification of experimental ultrasound imaging system), Assist. Prof. **J. Żmigrodzki** (supervisor), M.Sc. degree with honours.

[MSc8] Łukasz Tadeusz Dańko: *„Oprogramowanie układowe kart odczytu danych elektrycznego tomografu pojemnościowego EVT4"* (Embedded software for readout boards of the EVT4 electrical capacitance tomograph), Prof. **W. Smolik** (supervisor).

[MSc9] Wojciech Enzelm: *"Układ odczytu do mini gamma kamery"* (Readout circuit designed for mini gamma camera), Senior Lecturer **T. Olszewski** (supervisor).

[MSc10] Karolina Teresa Gabor: *"Badanie wpływu cech twarzy osoby na postrzeganie urody innych osób"* (Study the impact of a person's facial features on the perception of the beauty of others), Assist. Prof. **J. Naruniec** (supervisor).

[MSc11] Michał Gdowski: *"Analiza funkcji kognitywnych w e-sporcie na przykładzie gry Dota 2"* (Cognitive function analysis in e-sport based on Dota 2), Prof. **P. Bilski** (supervisor), studies in English.

[MSc12] Jagoda Katarzyna Głowacka: *"Badanie i analiza wybranego modelu opisującego dynamikę glukozowo-insulinową u pacjentów z cukrzycą typu 1"* (Study and analysis of a selected model describing glucose-insulin dynamics for patients with type 1 diabetes mellitus), Assist. Prof. **D. Radomski** (supervisor).

[MSc13] Magda Hartman: *"Analiza sekwencji dźwiękowych partii smyczkowych zarejestrowanych różnymi technikami mikrofonowymi"* (Analysis of sound sequencies party of string instruments registered with different microphone techniques), Assist. Prof. **M. Lewandowski** (supervisor).

[MSc14] Marta Anna Jaczyńska: *„Badania algorytmów rozpoznawania utworów muzycznych wykorzystujących zapytania przez przykład"* (The study music recognition algorithms using queries by example), Senior Lecturer **P. Bobiński** (supervisor).

[MSc15] Adam Kazimierz Jaworski: *"Modelowanie gazowych detektorów promieniowania gamma"* (Modeling gas detectors of gamma radiation), Assist. Prof. **R. Szabatin** (supervisor).

[MSc16] Piotr Paweł Klonowski: *„System antenowy na pasmo S dla system łączności minisatelity"* (The antenna system on S-band

for minisatellite communication), Assist. Prof. **K. Kurek** (supervisor).

[MSc17] Aleksandra Kolasa: *"Program do rekonstrukcji obrazu w komputerowej tomografii rentgenowskiej dla wiązki rozbieżnej"* (Program for image reconstruction in computed X-ray tomography for fan beam), Assist. Prof. **G. Domański** (supervisor)

[MSc18] Łukasz Marcin Kołodziejczak: *„Badania i realizacja cyfrowych odpowiedników filtrów analogowych dedykowanych do zastosowań w technice fonicznej"* (Studies and implementation of digital filters emulating analog equivalents used in professional audio industry), Senior Lecturer **P. Bobiński** (supervisor).

[MSc19] Kinga Kondracka: *„Ocena żywotności komórek przy użyciu struktur ISFET z modyfikowanym obszarem bramki"* (Cell vitality assessment using ISFET transistors with modified gate area), Assist. Prof. **P. Firek** (supervisor).

[MSc20] Bartosz Kordaczuk: *„Rozpoznawanie obiektów w obrazach rastrowych przy użyciu splotowych sieci neuronowych z wykorzystaniem Microsoft Hololens"* (Recognition of objects the raster images with usage of convolutional neural networks and Hololens), Assist. Prof. **J. Naruniec** (supervisor).

[MSc21] Joanna Kamila Kotynia: *„Przetwarzanie i analiza sygnału EKG metodą EMD"* (Processing and analysis of the ECG signal with EMD method), Assist. Prof. **G. Domański** (supervisor).

[MSc22] Jerzy Władysław Koziołkiewicz: *"Analiza algorytmów estymacji dysparcji stereowizyjnej"* (Analysis of the stereovision disparity estimation algorithms), Prof. **G. Pastuszak** (supervisor).

[MSc23] Karolina Maria Kucharska: *„Geolokalizacyjny system rozproszony z wykorzystaniem rzeczywistości rozszerzonej"* (Geolocation distributed system with Augmented Reality), Prof. **P. Bilski** (supervisor).

[MSc24] Krysztof Lech Kucharski: *„Zastosowanie splotowych sieci neuronowych w systemach automatycznej klasyfikacji obrazów cyfrowych"* (Convolutional neural networks applications in systems of automatic image classification), Assist. Prof. **G. Galiński** (supervisor).

[MSc25] Filip Kulpa: *„Implementacja, wdrożenie i testy internetowego systemu udostępniania materiałów dydaktycznych"* (Implementation, deployment and testing of the online system for sharing teaching materials), Assist. Prof. **K. Ignasiak** (supervisor).

[MSc26] Yunus Emre Kursav: *„Frame identification using mobile video"*, Prof. **W. Skarbek** (supervisor), studies in English.

[MSc27] Konrad Maciąg: *"Analiza możliwości wykorzystania modułu radia SDR do demodulacji sygnału DVB-T"* (Analysis of the possibilities of using the SDR radio module to demodulate DVB-T signal), Assist. Prof. **S. Kozłowski** (supervisor).

[MSc28] Milena Maćkowska: *"Projekt i optymalizacja hurtowni danych dla ruchu lotniczego"* (Design and optimization of a data warehouse for air traffic), Prof. **P. Bilski** (supervisor).

[MSc29] Albert Stanisław Malewski: *„Wykorzystanie systemu operacyjnego Android w wybranych zastosowaniach fonicznych"* (The use of the Android operating system in selected audio applications), Prof. **Z. Kulka** (supervisor).

[MSc30] Ernest Rafał Miller: *„Rezonansowy wzmacniacz klasy E na częstotliwość 13.56 MHz"* (13.56 MHz class E RF power amplifier), Assist. Prof. **M. Mikołajewski** (supervisor).

[MSc31] Joanna Lidia Ochodek: *„Metody klasyfikacji schorzeń na podstawie danych z badań proteomicznych"* (Methods of disease classification from proteomic data), Assist. Prof. **T. Rubel** (supervisor).

[MSc32] Maciej Tomasz Odrowąż-Sypniewski: *„Badanie porównawcze systemów dźwięku przestrzennego"* (Study of different surround sound systems), Senior Lecturer **P. Bobiński** (supervisor).

[MSc33] Özbey Serhan: *„Implementation and optimization of FDTD Kernels by using Cache-Aware Time-Skewing algorithms",* Assist. Prof. **M. Sypniewski** (supervisor), studies in English.

[MSc34] Rafał Pilarczyk: *"Wirtualna rzeczywistość w obrazie dookólnym"* (Virtual reality for spherical images), Prof. **W. Skarbek** (supervisor).

[MSc35] Renata Maria Plucińska: „*Analiza metod cyfrowego przetwarzania sygnałów do efektywnego diagnozowania narkolepsji w rutynowym badaniu EEG"* (Anaysis of digital signal processing methods for effective narcolepsy diagnosis in a routine EEG test), Assist. Prof. **G. Domański** (supervisor).

[MSc36] Piotr Piotrowski: *„Nawigacja w pomieszczeniach z wykorzystaniem modułów Bluetooth Low Energy"* (Indoor navigation using Bluetooth Low Energy Modules), Assist. Prof. **J. Kołakowski** (supervisor).

[MSc37] Kamil Popiołek: *„Optymalizacja systemu rozpoznawania znaków towarowych"* (Optimization of trademark recognition system), Assist. Prof. **G. Galiński** (supervisor).

[MSc38] Kinga Rau: *"Wykorzystanie termowizji w testowaniu żywotności oka"* (The use of termography for iris liveliness testing), Prof. **A. Grzanka** (supervisor).

[MSc39] Katarzyna Roszczewska: *"Rozpoznawanie tożsamości z wykorzystaniem podpisu od-*

ręcznego on-line" (Identity recognition based on on-line signatures), Prof. **A. Pacut** (supervisor).

[MSc40] Piotr Różalski: *„Radiografia cyfrowa z odczytem pośrednim"* (Computed radiography with intermediate reading), Assist. Prof. **A. Rychter** (supervisor).

[MSc41] Mateusz Sieńczewski: *"Metodyka analizy obrazów tensora dyfuzji"* (Analysis method of diffusion tensor images), Assist. Prof. **E. Piątkowska-Janko** (supervisor).

[MSc42] Marlena Struk: *„Predykcja czasu retencji w badaniach proteomicznych"* (Prediction's methods of retention time in proteomic research), Assist. Prof. **T. Rubel** (supervisor).

[MSc43] Piotr Symonides: *"Generacja sygnałów o wysokostabilnej częstotliwości sterujących pracą układu DW1000"* (Generation of signals with highly stable frequency to control the DW1000 circuit), Senior Lecturer **R. Michnowski** (supervisor).

[MSc44] Adrian Stefan Szymczykiewicz: *"Selekcja funkcji HRTF dla optymalnych warunków odsłuchu"* (HRTF selection for optimal listening conditions), Prof. **J. Żera** (supervisor).

[MSc45] Rafał Andrzej Świerbutowicz: *"System zdalnego zarządzania plikami z interfejsem webowym"* (Remote file management system with web interface), Assist. Prof. **K. Ignasiak** (supervisor).

[MSc46] Artur Jakub Uklański: *„Ocena zmian w obrębie istoty białej i szarej na podstawie map ilościowych wyznaczonych z wykorzystaniem sekwencji MR"* (Studies on the white and grey matter based on a quantitative map determined by MR sequences), Assist. Prof. **E. Piątkowska-Janko** (supervisor).

[MSc47] Deniz Can Üner: *„Projektowanie numeryczne, analiza i optymalizacja anten do pozyskiwania energii promieniowania elektromagnetycznego"* (Numerical design, analysis and optimization of rectifying antenna), Assist. Prof. **M. Sypniewski** (supervisor), studies in English.

[MSc48] Marcin Paweł Wachowicz: *"Wzmacniacz klasy E o mocy wyjściowej 40 W i częstotliwości roboczej 90 MHz"* (Class E amplifier with 40 W output power and 90 MHz operating frequency), Assist. Prof. **W. Kazubski** (supervisor).

[MSc49] Artur Wierzejski: *"Oprogramowanie do sterowania modemem GSM/UMTS"* (GSM/UMTS modem control software), Assist. Prof. **J. Kołakowski** (supervisor).

[MSc50] Mateusz Woźniczka: *„Poprawa rozdzielczości obrazu metodą nakładania przesuniętych obrazów o niskiej rozdzielczości"* (Resolution improvement by imposition of shifted low resolution images), Assist. Prof. **A. Buchowicz** (supervisor).

[MSc51] Agata Julia Zakrzewska (Brodowska): *"Optymalizacja dawki w badaniach PET-CT w diagnostyce procesów chorobowych charakteryzujących się zwiększonym zużyciem glukozy"* (Optimization of injected dose in PET - CT in the diagnosis of disease processes characterized by an increased use of glucose), Assist. Prof. **R. Szabatin** (supervisor).

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

[MSc52] Andrzej Kręcijasz: *"Metody migracji do sieci opartych na protokole IPv6 w różnych sieciach teleinformatycznych"* (IPv6 transiton methods in different telecommunication networks), Assist. Prof. **E**. **Śliwa** (supervisor).

5.6. B.Sc. Degrees

[BSc1] Adam Anusiewicz: *„System adnotacji muzycznej oparty na gamifikacji"* (A system for labeling pices of music, based on gamification), Assist. Prof. **G. Galiński** (supervisor).

[BSc2] Robert Augustyniak: *„Opracowanie układu do transmisji danych z etykiety systemu lokalizacyjnego z wykorzystaniem łącza Bluetooth"* (Developement of Bluetooth module for positioning system tag data transmission), Assist. Prof. **J. Kołakowski** (supervisor).

[BSc3] Michał Bednarski: *"Urządzenie pozycjonujące położenie stolika na szynie przesuwnej"* (Device positioning the placement of the table on the sliding rail), Assist. Prof. **M. Sutkowski** (supervisor).

[BSc4] Olga Agata Błażejewska: *„Badanie obwiedni sygnału odsłuchowego płuc z wykorzystaniem pojęcia sygnału analitycznego"* (Analysis of the envelope of the respiratory sound signals using the notion of the analytic signal), Assoc. Prof. **K. Snopek** (supervisor).

[BSc5] Mariusz Chabera: *"Układ do pomiaru energii wiązki elektronowej w trakcie impulsu akceleratora wielkiej częstotliwości"* (A circuit for measuring electron beam's energy during high frequency accelerator's impulse), Assist. **M. Ziembicki** (supervisor).

[BSc6] Damian Andrzej Chamot: *„Projekt architektury sprzętowej i programowej wspomagającej społeczność wspinaczkową"* (Hardware and software architecture design supporting climbing community), Prof. **P. Bilski** (supervisor).

[BSc7] Mateusz Sebastian Chomiczewski: *„Antena aktywna do odbioru sygnałów GPS w paśmie L2"* (Active antenna for L2 band of the GPS system), Assist. Prof. **W. Kazubski** (supervisor).

[BSc8] Robert Chrzanowski: *„Komputerowe narzędzie do generowania mimiki twarzy"* (Computer tool for generating facial expressions), Assist. Prof. **B. Sawionek** (supervisor).

[BSc9] Maja Anna Cudnok: *„Analiza porównawcza sygnału EMG i sił nacisku GRF podczas chodu"* (Comparative analysis of EMG signals and Ground Reaction Force during walking), Assist. Prof. **Z. Wawrzyniak** (supervisor).

[BSc10] Piotr Cyran: *"Projekt oraz implementacja bezprzewodowego systemu komunikacji w studiu nagraniowym"* (Design and implementation of a wireless communication system in a recording studio), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc11] Jakub Jan Czyż: *„Oprogramowanie w języku Java dla tomografu pojemnościowego EVT4 do sterowania, akwizycji danych i rekonstrukcji obrazów"* (Java software for capacitance tomograph EVT4 used for control, data acquisition and image reconstruction), Prof. **W. Smolik** (supervisor).

[BSc12] Maciej Daniluk: *„Analiza kształtu sygnału fali tętna – PWA"* (Pulse wave analysis), Senior Lecturer **T. Jamrógiewicz** (supervisor).

[BSc13] Łukasz Dąbrowski: *„Dwutaktowa przetwornica napięcia stałego"* (The flyback converter DC/DC), Assist. Prof. **M. Mikołajewski** (supervisor).

[BSc14] Magdalena Domagała: *„System do bezprzewodowego monitorowania sygnału EKG współpracujący z suchymi elektrodami"* (Wireless circulatory system monitoring device with dry electrodes), Assist. Prof. **G. Domański** (supervisor).

[BSc15] Bartłomiej Łukasz Druszcz: „*Inteligentny czujnik poboru prądu z interfejsem Wi-Fi"* (Inteligentny czujnik poboru prądu z interfejsem Wi-Fi), Assist. **R. Łukaszewski** (supervisor).

[BSc16] Kaja Maria Etmanowicz: *„Analiza porównawcza sygnału EMG podczas chodu"* (Comparative analysis of EMG signal during walking), Assist. Prof. **Z. Wawrzyniak** (supervisor).

[BSc17] Piotr Zbigniew Fryś: *"Serwis internetowy udostępniający wyniki jakościowych badań proteomicznych"* (Website provides the scores of quality proteomics examinations), Assist. Prof. **T. Rubel** (supervisor).

[BSc18] Bartłomiej Garnek: *"Aplikacja wspomagająca synchronizację czasową materiału dźwiękowego nagranego techniką wielościeżkową"* (Application supporting time synchronization of audio material recorded using multi-track recording technique), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc19] Małgorzata Grocka: *"Analiza obrazów uszkodzeń rdzenia kręgowego w wybranym systemie archiwizacji obrazów"* (Image analysis of spinal cord injury in selected image archiving system), Assist. Prof. **B. Sawionek** (supervisor).

[BSc20] Robert Krzysztof Grodecki: *„System obsługi karnetów w ośrodku narciarskim"* (Skipass validation system for mountain destinations), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc21] Bartosz Gruszka: *"Modelowanie liczników proporcjonalnych promieniowania gamma"* (Modeling proportional counters of gamma projection), Assist. Prof. **R. Szabatin** (supervisor).

[BSc22] Krzysztof Jankowski: *„Stanowisko do wspomagania wzorcowania wybranych obiektów"* (The measurement station to suport calibration selected objects), Assist. Prof. **A. Podgórski** (supervisor).

[BSc23] Krzysztof Jesień: *„Web application for presentation of measurement data"* (Aplikacja webowa do prezentacji danych pomiarowych), Assist. Prof. **A. Podgórski** (supervisor), studies in English.

[BSc24] Tomasz Kaczorowski: *"Biblioteka sekwencji obrazujących MRI"* (Library of MRI imaging sequences), Assist. **W. Obrębski** (supervisor).

[BSc25] Konrad Karaś: *„Nowy typ gazowego detektora pozycyjnego na bazie igieł do akupunktury"* (A new type of positional gas ionization detector based on acupuncture needles), Assist. Prof. **R. Szabatin** (supervisor).

[BSc26] Emilia Kiryk: „*Projekt sprężystego pierścienia uszczelniającego do komorowej protezki strzemiączka"* (Design of a resilient ring for middle ear's chamber stapes prosthesis), Assoc. Prof. **M. Kwacz** (supervisor).

[BSc27] Łukasz Klimowicz: *„Opracowanie modułu wyznaczania trasy przemieszczania się obiektu z wykorzystaniem układu BNO055"* (Development of the BNO055 based module for an object tracking), Assist. Prof. **J. Kołakowski** (supervisor).

[BSc28] Michał Kłaczkow: *„Projekt i realizacja systemu do pomiaru skuteczności pracy aparatu słuchowego w warunkach zakłócania szumem kierunkowym"* (Design and implementation of the hearing aid efficiency measure system under directional noise), Senior Lecturer **P. Bobiński** (supervisor).

[BSc29] Michał Kocon: *„Opracowanie ultraszerokopasmowego lokalizatora obiektów"* (Development of ultra-wideband object locator), Assist. Prof. **J. Kołakowski** (supervisor).

[BSc30] Aleksander Kołodziejczyk: *„Przycisk bezpieczeństwa do smartfonów"* (The safety button for smartphones), Assist. Prof. **M. Rupniewski** (supervisor), B.Sc. degree with honours.

[BSc31] Robert Oskar Kopaczel: *„Inteligentny czujnik w interfejsie Bluetooth 4.0"* (Smart sensor using Bluetooth 4.0 standard), Assist. **R. Łukaszewski** (supervisor).

[BSc32] Filip Jerzy Kowalski: *"Porównanie algorytmów detekcji punktów charakte-*

rystycznych twarzy w obrazach cyfrowych" (Comparison of algorithms of the facial features detection in digital images), Assist. Prof. **J. Naruniec** (supervisor).

[BSc33] Paweł Krawczyk: *"Biblioteka procedur do wyznaczania rozkładu pola elektrycznego dla pakietu ECTsim 2D do modelowania w elektrycznej tomografii pojemnościowej"* (Library of procedures for calculation of potential distribution for ECTSim 2D to model in electrical capacitance tomography), Prof. **W. Smolik** (supervisor).

[BSc34] Wojciech Kacper Krupka: *"Cykliczna funkcja autokorelacji i cykliczne widmo sygnału EEG"* (Cyclic autocorrelation function and cyclic spectrum of EEG signals), Assoc. Prof. **K. Snopek** (supervisor).

[BSc35] Mikołaj Iwo Krzyszczak: *"System rozpoznawania emocji twarzy"* (Facial emotion recognition system), Assist. Prof. **J. Naruniec** (supervisor).

[BSc36] Mateusz Jan Kubiak: *„Fantom p*rzepływu *krwi do badań ultrasonograficznych"* (Blood flow phantom for ultrasound studies), Senior Lecturer **T. Jamrógiewicz** (supervisor).

[BSc37] Daria Kukareka: *"Aplikacja do zarządzania systemem monitoringu wizyjnego"* (Web application for CCTV management), Assist. Prof. **A. Buchowicz** (supervisor).

[BSc38] Katarzyna Kułak: *"Oprogramowanie przeglądarki medycznych danych obrazowych w standardzie DICOM"* (Application for displaying medical images in DICOM format), Assist. Prof. **R. Kurjata** (supervisor).

[BSc39] Paweł Lipka: *"Wzmacniacz niskoszumny na pasmo X z tranzystorem GaN-HEMT"* (Low noise amplifier for X bandwidth based on GaN-HEMT transistor), Assist. Prof. **D. Gryglewski** (supervisor).

[BSc40] Piotr Michał Łazarczyk: "*Replication system for imaging data"* (System replikacji danych obrazowych), Assist. Prof. E**. Piątkowska-Janko** (supervisor), studies in English.

[BSc41] Arkadiusz Łysiak: *"Wirtualny multimetr 34401A na platformę Silverlight"* (Virtual Digital Multimeter 34401A on Silverlight platform), Assist. **R. Łukaszewski** (supervisor).

[BSc42] Dhruv Mahajan: *"Digital audio watermarking"* (Cyfrowe znakowanie wodne plików dźwiękowych), Prof. **P. Dymarski** (supervisor), studies in English.

[BSc43] Jacek Aleksander Majdecki: *"Przenośny dozymetr z licznikiem Geigera-Müllera"* (Handheld Geiger-Müller tube dosimeter), Assist. Prof. **G. Domański** (supervisor).

[BSc44] Damian Małek: *"Analiza pasywna lasera półprzewodnikowego z pryzmatyczną mikrownęką rezonansową"* (Passive analysis of semiconductor laser with prismatic micro resonant cavity), Assoc. Prof. **B. Salski** (supervisor).

[BSc45] Rafał Martyka: *"Projekt małego smartfonu wodnego do pomiarów wiązek akceleratorów medycznych"* (The scheme of small water phantome to measure parameters of beams of medical accelerators), Assoc. Prof. **S. Wronka** (supervisor).

[BSc46] Maciej Matuszczak: *"Rezonansowy wzmacniacz mocy klasy D do laboratorium studenckiego"* (Resonant Class D amplifier as experimental circuit to students' laboratory), Assist. Prof. **M. Mikołajewski** (supervisor).

[BSc47] Mateusz Midura: *"Gazowy detektor pozycyjny do wykrywania promieniowania gamma"* (New type position-sensitive gamma ray gaseous detector), Assist. Prof. **R. Szabatin** (supervisor).

[BSc48] Paweł Hubert Misiak: *"Projekt mikrokontrolera do kontroli pieca grzewczego z interfejsem mobilnym"* (The project of microcontroller for heating furnace with mobile interface), Assist. Prof. **P. Miazga** (supervisor), studies in English.

[BSc49] Andrzej Jarosław Musiał: *„Mikrofalowy syntezer PLL o dużej szybkości przestrajania"* (A microwave PLL-synthesizer with minimized frequency switching time), Assist. Prof. **P. Korpas** (supervisor).

[BSc50] Patrycja Aleksandra Naumczyk: *"Oprogramowanie do analizy badań czynnościowego rezonansu magnetycznego w środowisku MATLAB"* (Software for functional Magnetic Resonance Imaging analyses in MATLAB enviroment), Assist. Prof. **E. Piątkowska-Janko** (supervisor), Warsaw University of Technology Distant Learning Center (Ośrodek Kształcenia na Odległość PW).

[BSc51] Ewa Nieporęcka: *„Tworzenie aplikacji do wspomagania decyzji diagnostyczno - terapeutycznych w ostrej zatorowości płucnej"* (Application for supporting diagnosis and treatment of pulmonary embolism), Prof. **J. Mulawka** (supervisor).

[BSc52] Hanna Irena Nykowska: *„Feature selection and classification of neuroimaging data"* (Selekcja cech oraz klasyfikacja danych z badań neuroobrazowych), Assist. Prof. **E. Piątkowska-Janko** (supervisor), B.Sc. degree with honours.

[BSc53] Paweł Orzech: *"Rezonansowy wzmacniacz mocy klasy E o niskich stratach mocy przy dowolnej rezystancji obciążenia"* (Class DE amplifier with low energy losses working with any output resistance), Assist. Prof. **M. Mikołajewski** (supervisor).

[BSc54] Elena Maria Paciorkiewicz: *„Aplikacja instalacji artystycznej z wykorzystaniem algorytmów analizy obrazu"* (Application of art installation based on algorithms of image analysis), Assist. Prof. **J. Naruniec** (supervisor).

[BSc55] Filip Paczkowski: *„Internetowy system identyfikacji utworu muzycznego z wyko-*

rzystaniem sztucznej inteligencji" (Web service for song identification using artificial intelligence), Prof. **P. Bilski** (supervisor).

[BSc56] Dominik Tadeusz Pasternak: *"Internetowy system do przechowywania i analizy plików dźwiękowych z wykorzystaniem metod cyfrowego przetwarzania sygnałów"* (Storage and analysis audio files Internet system with usage of digital signal processing methods), Prof. **P. Bilski** (supervisor).

[BSc57] Paweł Pawelec: *„Projekt i realizacja trójdrożnej zwrotnicy głośnikowej"* (Design and implementation of a three-way speaker crossover), Assist. Prof. **G. Makarewicz** (supervisor).

[BSc58] Izabela Pietrzyk: *„Układ do cyfrowej rejestracji akustycznego sygnału kaszlu"* (The layout for the digital recording of the acoustic cough signal), Prof. **T. Pałko** (supervisor).

[BSc59] Aleksandra Piotrowska: *"Aplikacja webowa wspierająca sekwencjonowanie DNA"* (Web application for DNA sequencing suport), Prof. **J. Mulawka** (supervisor).

[BSc60] Filip Ireneusz Płacheta: *„Wirtualny przyrząd pomiarowy na platformę Android"* (Virtual measuring device on Android platform), Assist. **R. Łukaszewski** (supervisor).

[BSc61] Małgorzata Pudlik: *„Nowa komorowa proteza strzemiączka – modyfikacja geometrii i stworzenie dokumentacji CAD"* (Design of a resilient ring for middle ear's chamber stapes prothesis), Assoc. Prof. **M. Kwacz** (supervisor).

[BSc62] Barbara Rozwałka: *„Pasywna akustyczna lokalizacja wzajemna"* (Passive acoustic mutual localization), Assist. Prof. **M. Rupniewski** (supervisor).

[BSc63] Maja Skrobisz: *„System "wideo na żądanie" na urządzenia mobilne"* (Video on demand system for mobile devices), Assist. Prof. **G. Galiński** (supervisor).

[BSc64] Julita Sobótka: *„Projekt aplikacji do tworzenia trójwymiarowego profilu geotechnicznego"* (Application design for creating a three-dimensional geotechnical profile), Prof. **P. Bilski** (supervisor).

[BSc65] Karolina Anna Soczewka: „Baza danych współpracująca z mikrokontrolerowym testerem lamp elektronowych" Database cooperating with micro-controller tube tester), Assist. Prof. **G. Makarewicz** (supervisor).

[BSc66] Joanna Sołowińska: *„Pulsoksymetr z wysokościomierzem baromtrycznym dla pilotów szybowcowych"* (Pulse oximeter and barometric altimeter for glider pilots), Assist. Prof. **G. Domański** (supervisor).

[BSc67] Adam Jakub Swidziński: *"Sterowany cyfrowo zasilacz impulsowy mikroprocesorowego testera lamp elektronowych"* (Switching power supply for pulse tube measurement), Assist. Prof. **G. Makarewicz** (supervisor).

[BSc68] Mateusz Szczepkowski: *„Zręcznościowa gra komputerowa z rozgrywką wieloosobową"* (Arcade computer game with multiplayer), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc69] Katarzyna Szeligowska: *„Analiza sieci połączeń na podstawie badań strukturalnych"* (Analysis of connections network based on structural research), Assist. Prof. **E. Piątkowska-Janko** (supervisor).

[BSc70] Jakub Szklarski: *"Platforma integracyjna dla system płatności mobilnych "Elektroniczny Parkometr"* (Integration platform for mobile payments system „Electronic Parkometer"), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc71] Marcin Jan Szybiński: *„Wzmacniacz tensometryczny z wyjściem cyfrowym dla platformy dynamometrycznej"* (Tensometric amplifier with digital output for force platform), Assist. Prof. **A. Rychter** (supervisor).

[BSc72] Tomasz Tabaczuk: *„Wysokosprawny konwerter DC/DC+AC sterowany sygnałem audio do modulatora AM"* (High-performance DC/DC+AC converter for AM modulator controlled by an audio signal), Senior Lectuter **H. Chaciński** (supervisor).

[BSc73] Aleksandra Agnieszka Wardak: *„Projekt i realizacja oprogramowania do analizy czystości nagrania wokalnego lub instrumentalnego"* (Software design and implementation for in tune analysis of vocal or instrumental recording), Senior Lecturer **P. Bobiński** (supervisor).

[BSc74] Adam Wądołkowski: *„Interfejs www dla elektrycznego tomografu pojemnościowego"* (Web interface for electrical capacitance tomograph) Assistant **J. Kryszyn** (supervisor).

[BSc75] Mateusz Werczyński: *"Implementacja modułu cyfrowego generatora i analizatora widmowego sygnałów dźwiękowych w technologii VST"* (Implementation of a sine oscillator and a spectrum analyzer in VST), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc76] Wioletta Wielgomas: *„Modyfikacja tytanu i jego stopów w aspekcie zastosowania do implantów kardiologicznych"* (Modifications of titanium and its alloys for cardiovascular implants applications), Prof. **T. Wierzchoń** (supervisor).

[BSc77] Michał Wierzbicki: *„Detekcja sygnałów mikrofonu bezprzewodowego z wykorzystaniem metody uśredniania widma"* (Detection of a wireless microphone signals by means of the spectrum averaging method), Assist. Prof. **S. Kozłowski** (supervisor).

[BSc78] Marcin Wiktorowicz: *"Układ do przestrzennego pomiaru rozkładu promieniowania jonizującego"* (The system for spatial measurement of ionizing radiation), Assoc. Prof. **S. Wronka** (supervisor).

[BSc79] Radosław Wiliński: *"Generator kluczy kryptograficznych ze sprzętowym generatorem liczb losowych dla systemów wymiany danych medycznych"* (Cryptographic key generator based on a true random number generator for medical data exchange), Assist. **R. Kurjata** (supervisor)

[BSc80] Marta Wolszczak: *"Endoproteza stawu biodrowego typu custom design - symulacyjny dobór optymalnej geometrii"* (Custom hip joint endoprothesis - the simulation choice of optimum geometry), Assoc. Prof. **M. Kwacz** (supervisor).

[BSc81] Ewa Anna Woźny: *„Implementacja algorytmu lokalizacyjnego w systemie z procesorem ARM Cortex-A8"* (The implementation of the localization algorithm in the ARM Cortex-A8 system), Assist. Prof.**J. Kołakowski** (supervisor).

[BSc82] Miłosz Piotr Wyrzykowski: *„Uniwersalny front-end nadajnika klasy SDR"* (Universal front-end for SDR transmitter), Assist. Prof. **D. Rosołowski** (supervisor).

[BSc83] Agnieszka Zyśk: *„Wzmacniacz sterujący z tranzystorem GaN HEMT do modułu N/O na pasmo X"* (GaN HEMT amplifier for X T/R module band), Assoc. Prof. **W. Wojtasiak** (supervisor).

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

[BSc84] Jakub Piotr Hoim: *"Automatyczny tuner antenowy na zakres fal krótkich"* (Automatic antenna tuner for short wave range), Assist. Prof. **D. Rosołowski** (supervisor).

[BSc85] Daniel Kornet: *"Wirtualny multimetr z wykorzystaniem LabView"* (Virtual multimeter using LabView), Prof. **W. Winiecki** (supervisor).

6. PUBLICATIONS

6.1. Scientific and technical books, chapters in books

[Pub1] P. Bilski, P. Mazurek, J. Wagner, W. Winiecki: "Decision Trees Implementation in Monitoring of Elderly Persons Based on the Depth Sensors Data", in: *Computer Systems for Healthcare and Medicine,* P. Bilski, F. Guerriero (Eds.), Denmark: *River Publishers,* 2017, ISBN: 978-87--93519-31-2, pp. 193-211.

[Pub2] Ł. Błaszczyk, K. Werys, A. Kubik, P. Bogorodzki: „Gabor-Filter-based Longitudinal Strain Estimation from Tagged MRI", in: *Computer Systems for Healthcare and Medicine,* P. Bilski, F. Guerriero (Eds.), Denmark: *River Publishers,* 2017, ISBN: 978-87-93519-31-2, pp. 129-139.

[Pub3] S. Jankowski, Z. Szymański, U. Dziomin, P. Mazurek, J. Wagner: „Deep Learning Classifier for Fall Detection Based on IR Distance Sensor Data", in: *Computer Systems for Healthcare and Medicine,* P. Bilski, F. Guerriero (Eds.), Denmark: *River Publishers,* 2017, ISBN: 978-87--93519-31-2, pp. 169-192.

[Pub4] J. Kołakowski, M. Berezowska, R. Michnowski, K. Radecki, Ł. Malicki: „A System for Elderly Persons Behaviour Wireless Monitoring", in: *Computer Systems for Healthcare and Medicine,* P. Bilski, F. Guerriero (Eds.), Denmark: *River Publishers,* 2017, ISBN: 978-87-93519-31-2, pp. 31-50.

[Pub5] J. Kołakowski, A. Consoli, V. Djaja-Jośko, J. Ayadi, L. Moriggia, F. Piazza: „EIGER Indoor UWB-Positioning System", in: *Computer Systems for Healthcare and Medicine,* P. Bilski, F. Guerriero (Eds.), Denmark: *River Publishers,* 2017, ISBN: 978--87-93519-31-2, pp. 95-112.

[Pub6] T. T. Sudmann, I. T. Børsheim, T. Ciamulski, J. Wagner, K. Øvsthus, F. F. Jacobsen: "Ultra-Wide Band Radar Monitoring of Movements in Homes of Elderly and Disabled People: A Health Care Perspective", in: *Computer Systems for Healthcare and Medicine,* P. Bilski, F. Guerriero (Eds.), Denmark: *River Publishers,* 2017, ISBN: 978-87-93519-31-2, pp. 1-29.

[Pub7] J. Szczyrek, W. Winiecki: "On Detection and Estimation of Breath Parameters Using Ultrawide Band Radar", in: *Computer Systems for Healthcare and Medicine,* P. Bilski, F. Guerriero (Eds.), Denmark: *River Publishers,* 2017, ISBN: 978-87-93519-31-2, pp. 113-127

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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 specified in a simplified way, *viz.*: only the first author and all the authors from the Faculty have been listed and the number of other authors has been provided in brackets.

[Pub8] K. Abe (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (313 external authors): „Combined Analysis of Neutrino and Antineutrino Oscilliations at T2K", *Physical Review Letters*, vol. 118 issue 15, 2017, pp. 151801-1-151801-9.

[Pub9] K. Abe (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (363 external authors): „First Measurement of the Muon Neutrino Charged Current Single Pion Production Cross Section on Water with the T2K Near Detector", *Physical Review D*, vol. 95, 2017, pp. 012010-1--012010-11.

[Pub10] K. Abe (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (347 external authors): „Search for Lorentz and CPT Violation Using Sidereal Time Dependence of Neutrino Flavor Transitions over a Short Baseline", *Physical Review D*, vol. 95, 2017, pp. 111101-1-111101-9.

[Pub11] K. Abe (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (320 external authors): „Updated T2K Measurements of Muon Neutrino and Antineutrino Disappearance Using 1.5 x 10^{21} Protons on Target", *Physical Review D*, vol. 96, 2017, pp. 011102-1-011102-9.

[Pub12] K. Abe (…), R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (296 external authors): „Measurement of Neutrino and Antineutrino Oscillations by the T2K Experimental Including a New Additional Sample of ν_e Interactions at the Far Detector", *Physical Review D,* vol. 96, 2017, pp. 09-2006-1-092006-49.

[Pub13] K. Abe (…), R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (290 external authors): "Measurement of $\bar{\nu}\mu$ and $\nu\mu$ Charged Current Inclusive Cross Sections and their Ratio with Off-Axis Near Detector", *Physical Review D*, vol. 96, 2017, pp. 052001-1-052001-15.

[Pub14] S. R. Adaszewski, D. Slater, L. Mele-Garcia, B. Dragański, P. Bogorodzki: „Simultaneous Estimation of Population Receptive Field and Hemodynamic Parameters from Single Point BOLD Responses Using Metropolis-Hastings Sampling", *Neuro-*

image 2017, doi: 10.1101/233619, available online.

[Pub15] C. Adolph (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (227 external authors): „Multiplicities of Charged Kaons from Deep--Inelastic Muon Scattering off an Isoscalar Target", *Physics Letters B*, vol. 767, 2017, doi: 10.1016/j.physlet.2017.01.053, pp. 133-141.

[Pub16] C. Adolph (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (COMPASS Collaboration; 25 external authors): „Leading-Order Determination of the Gluon Polarisation from Semi-Inclusive Deep Inelastic Scattering Data", *European Physical Journal C*, vol. 77, no. 209, 2017, doi: 10.1140/epjc/s10052-017-4716-x, 12 pp.

[Pub17] C. Adolph (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (197 external authors): „Multiplicities of Charged Pions and Charged Hadrons from Deep-Inelastic Scattering of Muons off an Isoscalar Target", *Physics Letters B*, vol. 764, 2017, pp. 1-10.

[Pub18] C. Adolph (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (204 external authors): „Resonance Production and π π S-Wave in π^- $+\rho \rightarrow \pi^-\pi^-\pi^+ + \rho_{recoil}^-$ at 190 GeV/c", *Physical Review D*, vol. 95, issue 3, 2017, pp. 032004-1-032004-59.

[Pub19] C. Adolph (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (226 external authors): „Exlusive ω Meson Muoproduction on Transversely Polarised Protons", *Nuclear Physics B*, vol. 95, 2017, doi: 10.1016/j.nuclphysb.2016.12.015, pp. 454-475.

[Pub20] C. Adolph (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (221 external authors): „Sivers Asymmetry Extracted in SIDIS at the Hard Scales of the Drell-Yan Process at COMPASS", *Physics Letters B*, vol. 770, 2017, pp. 138-145.

[Pub21] C. Adolph (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (282 external authors): „Final COMPASS Results on the Deuteron Spin--Dependent Structure Function g^d_1 and the Bjorken Sum Rule", *Physics Letters B*, vol. 769, 2017, pp. 34-41.

[Pub22] C. Adolph (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (245 external authors): "First Measurement of the Sivers Asymmetry for Gluon Using SIDIS Data", *Physics Letters B*, vol. 772, 2017, pp. 854-864.

[Pub23] M. Aghasyan (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (218 external authors): „First Measurement of Transverse-Spin-Dependent Azimuthal Asymmetries in the Drell-Yan Process", *Physical Review Letters*, vol. 119, issue 11, 2017, doi: 10.1103--/PhysRevlett119.112002, pp. 112002-1--112002-7.

[Pub24] M. Antonello (…), P. Płoński, K. Zaremba (54 external authors): „Muon Momentum Measurement in ICARUS-T600 LAr-TPC via Multiple Scattering in Few-GeV Range", *Journal of Instrumentation*, vol. 12, 2017, doi: 10.1088/1748-0221/12/04/P04010, 5 pp.

[Pub25] A. Badeńska, Ł. Błaszczyk: "Compressed Sensing for Real Measurements of Quaternion Signals", *Journal of the Franklin Institute*, vol. 354, 2017, pp. 5753-5769.

[Pub26] P. Bilski, P. Bobiński, A. Krajewski, P. Witomski: "Detection of Wood Boring Insects' Larvae Based on the Acoustic Signal Analysis and the Artificial Intelligence Algorithm", *Archives of Acoustics,* vol. 42, no. 1, 2017, doi: 10.1515/aoa-2017-0007, pp. 61-70.

[Pub27] K. Chyl, B. Kossowski, A. Dębska, M. Łuniewska, A. Banaszkiewicz, A. Żelechowska, S. J. Frost, W. E. Mencl, M. Wypych, A. Marchewka, K. R. Pugh, K. Jednoróg: „Prereader to Beginning Reader: Changes Induced by Reading Acquisition in Print and Speech Brain Networks", *Journal of Child Psychology and Psychiatry*, 2017, doi: 10.111/jcpp.12774, 5 pp.

[Pub28] S. Guo (…), P. Bogorodzki (145 external authors): "Conversion Discriminative Analysis on Mild Cognitive Impairment Using Multiple Cortical Features from MR Images", *Frontiers in Aging Neuroscience* no. 9, 2017, doi: 10.3389/fnagi.2017.001- 46, 14 pp.

[Pub29] J. Kołakowski, V. Djaja-Jośko, M. Kołakowski: „UWB Monitoring System for AAL Applications", *Sensors*, vol. 17, issue 9, 2017, doi: 10.3390/s17092092, 21 pp.

[Pub30] P. Kopyt, B. Salski, P. Zagrajek, D. Obrębski, J. Marczewski: „Modeling of Silicon-Based Substrates of Patch Antennas Operating in the Sub-THz Range", *IEEE Transactions on Terahertz Science and Technology*, 2017, 9 pp.

[Pub31] M. Kordus, J. Żera: "Loudness Functions and Binaural Loudness Summation in Bilateral Cochlear Implant Users", *Archives of Acoustics*, vol. 42, issue 3, 2017, pp. 351--364.

[Pub32] J. Krupka, P. Aleshkevych, B. Salski, P. Kopyt, A. Pacewicz: „Ferromagnetic Resonance Revised – Electrodynamic Approach", *Scientific Reports – Nature*, no. 7, 2017, doi: 10.1038/s41598-017-05827-7, 6 pp.

[Pub33] J. Krupka, P. Aleshkevych, B. Salski, P. Kopyt: „Magnetodynamic Study of Spin Resonances in Cylindrical and Spherical YIG Samples", *IEEE Transactions on Mi-*

crowave Theory and Technique, 2017, 10 pp.

[Pub34] J. Krupka, P. Aleshkevych, B. Salski, P. Kopyt, "Ferromagnetic Linewidth Measurements Employing Electrodynamic Model of the Magnetic Plasmon Resonance", *Measurement Science and Technology*, 2017, 6 pp.

[Pub35] J. Kryszyn, P. Wróblewski, M. Stosio, D. Wanta, T. Olszewski, W. T. Smolik: „Architecture of EVT4 Data Acquisition System for Electrical Capacitance Tomography", *Measurement*, vol. 101, 2017, pp. 28--39.

[Pub36] J. Kryszyn, D. Wanta, W. Smolik: „Gain Adjustment for Signal-to-Noise Ratio Improvement in Electrical Capacitance Tomography System EVT4", *IEEE Sensors Journal,* 2017, 10 pp.

[Pub37] M. Nowakowska, A. Krajewski, P. Witomski, P. Bobiński: „Thermic Limitation of AE Detection Method of Old House Borer Larvae (*Hylotrupes bajulus L),* in Wooden Structures", *Construction and Building Materials*, vol. 136, 2017, pp. 446-449.

[Pub38] A. Nowakowski, W. Skarbek: "Calibration of Radial Lens Distortion Using a Gaussian Model", *Optical Engineering*, vol. 56, issue 10, 2017, doi: 10.1117/1.OE.56.10.103-103, pp. 103103-1-103103-11.

[Pub39] T. Pawełczyk, E. Piątkowska-Janko, P. Bogorodzki, P. Gębski, M. Grancow-Grabka, E. Trafalska, N. Żurner, A. Pawełczyk: „Omega-3 Fatty and Supplementation May Prevent Loss of Gray Matter Thickness in the Left Parieto-Occipital Cortex in First Episode Schizophrenia: A Secondary Outcome Analysis of the OFFER Randomized Controlled Study", *Schizophrenia Research*, 2017, 8 pp, available online.

[Pub40] P. Płoński, W. Gradkowski, I. Altarelli, K. Monzalvo, M. van Ermingen-Marbach, M. Grande, S. Helm, A. Marchewka, P. Bogorodzki, F. Ramus: „Multi-Parameter Machine Learning Approach to the Neuroanatomical Basis of Developmental Dyslexia", *Human Brain Mapping*, vol. 38, issue 2, 2017, doi: 10.1002/hbm.23426, pp. 900-908.

[Pub41] 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*, vol. 464, 2017, pp. 159-163.

[Pub42] B. Salski, M. Olszewska-Placha, T. Karpisz, J. Rudnicki, W. Gwarek, M. Maliszewski, A. Zofka, J. Skulski: „Microwave Applicator for Thermal Treatment of Bituminous Surfaces", *IEEE Transactions on Microwave Theory and Techniques*, 2017, vol. 65, no. 9, pp. 3419-3427.

[Pub43] W. T. Smolik, J. Kryszyn, B. Radzik, M. Stosio, P. Wróblewski, D. Wanta, Ł. Dańko, T. Olszewski, R. Szabatin: „Single--Shot High-Voltage Circuit for Electrical Capacitance Tomography", *Measurement Science and Technology*, vol. 28, no. 2, Dec. 2016, pp. 1-12.**

[Pub44] M. Świątkiewicz, M. Fiedorowicz, J. Orzeł, M. Wełniak-Kamińska, P. Bogorodzki, J. Langfort, P. Grieb: „Increases in Brain ^{1}H-MR Glutamine and Glutamate Signals Following Acute Exhaustive Endurance Exercise in the Rat", *Frontiers in Physiology*, vol. 8, no. 19, 2017, doi:10.3389/fphys.-2017.00-019, pp. 1-10.

[Pub45] J. Wagner, P. Mazurek, A. Miękina, R. Z. Morawski, F. F. Jacobsen, T. T. Sudmann, I. T. Børsheim, K. Øvsthus, T. Ciamulski: "Comparison of Two Techniques for Monitoring of Human Movements", *Measurement,* vol. 111, 2017, pp. 420-431.

[Pub46] K. Wróbel, R. Doroz, P. Porwik, J. Naruniec, M. Kowalski: „Using a Probabilistic Neural Network for Lip-Based Biometric Verification", *Engineering Applications of Artifical Intelligence*, vol. 64, 2017, pp. 112--127.

[Pub47] Y. Yashchyshyn, K. Derzakowski, G. Bogdan, K. Godziszewski, D. Nyzovets, C. H. Kim, B. Park: "28 GHz Switched-Beam Antenna Based on S-PIN Diodes for 5G Mobile Communications," *IEEE Antennas and Wireless Propagation Letters*, 2017, doi: 10.1109/LAWP.2017.2781262.

[Pub48] Y. Yashchyshyn, K. Godziszewski: "A New Method for Dielectric Characterization in Sub-THz Frequency Range", *IEEE Transactions on Terahertz Science and Technology,* vol. 8, no. 1, 2018, doi: 10.1109/-TTHZ.2017.2771309, available online, from Dec. 2017.

[Pub49] Y. Yashchyshyn, K. Godziszewski, G. Bogdan, P. Piasecki: „X-Band Antenna Array for Low-Cost Beam Scanning", *IET Microwaves, Antennas & Propagation*, 2017, doi: 10.1049/iet-map.2017.0205, pp. 2174-2178

[Pub50] D. Yavorskiy, K. Karpierz, P. Kopyt, M. Grynberg, J. Łusakowski: „Sub-Terahertz Emission from Field-Effect Transistors", *Acta Physica Polonica A*, vol. 132, no. 2, 2017, pp. 335-337.

**Paper indicated on this subsection as [Pub42] has not been published in the Annual Report 2016.

6.2.2. Part B

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

[Pub51] P. Bilski: "Charakterystyka zaawansowanych architektur sterowników PLC" (Characteristics of the Advanced Architectures of Programmable Logic Controllers), *Elektro.Info*, no. 3, 2017, pp. 31-37.

[Pub52] G. Bogdan, K. Godziszewski, P. R. Bajurko, Y. Yashchyshyn: “Stanowisko do badań systemów MIMO wielkiej skali w paśmie mikrofalowym i subterahercowym” (Facility for Massive MIMO Characterization in Microwave and Sub-Terahertz Range), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVI, no. 6, 2017, pp. 279-282.

[Pub53] P. Buczkowski, W. Skarbek: “Konwolucyjne sieci głębokie w programie nauczania technik multimedialnych w Zakładzie Telewizji” Politechniki Warszawskiej” (Convolutional Deep Neural Networks in Curriculum of Multimedia Technology at Television Division of Warsaw University of Technology), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVI, no. 6, 2017, pp. 342-345.

[Pub54] V. Djaja-Jośko: „Wykorzystanie filtru Kalmana do wyznaczania pozycji węzłów w ultraszerokopasmowym systemie lokalizacyjnym” (Use of Kalman Filter for Anchor Nodes’ Position Estimation in Ultrawideband Localization System), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVI, no. 6, 2017, pp. 429-432.

[Pub55] G. Domański, B. Konarzewski: „Analiza wzmacniacza transimpedancyjnego współpracującego z fotodiodą i przełączanymi źródłami światła” (Analysis of the Transimpedance Amplifier Working with a Photodiode and Switched Light Sources), *Elektronika – Konstrukcje – Technologie – Zastosowania*, no. 7, 2017, pp. 23-27.

[Pub56] G. Domański, B. Konarzewski, R. Kurjata, J. Marzec, K. Zaremba, A. Rychter, M. Ziembicki: „Analiza optymalnego czasu zerowania pojemności w integratorze kluczowanym” (Analysis of the Optimal Capacitance Reset Time in Switched Integrator), *Elektronika – Konstrukcje – Technologie-Zastosowania*, no. 2, 2017, pp. 11-13.

[Pub57] G. Domański, A. Jaworski, J. Kalenik, R. Szabatin, P. Wróblewski, W. Smolik, R. Kurjata, B. Konarzewski, M. Dziewiecki, J. Marzec, K. Zaremba, M. Ziembicki, A. Rychter, J. Kryszyn, P. Brzeski, J. Szmidt: „Gain Prediction Theory of Single Foil Gas Electron Multiplier Detector”, *Informatyka Automatyka Pomiary w Gospodarce i Ochronie Środowiska*, no. 1, 2017, pp. 130-132.

[Pub58] G. Domański, R. Szabatin, P. Brzeski, B. Konarzewski: “Needle Detector of X-ray and Gamma Radiation”, *Informatyka Automatyka Pomiary w Gospodarce i Ochronie Środowiska*, no. 1, 2017, pp. 121-124.

[Pub59] P. Hoffmann, Y. Yashchyshyn: “Badanie możliwości przestrajania częstotliwości rezonansowej anteny na pasmo 60 GHz za pomocą MEMS” (Study of the Possibility to Change the Resonating Frequency of a 60 GHZ Antenna with the Use of MEMS), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVI, no. 6, 2017, pp. 275-278.

[Pub60] J. Kołakowski, V. Djaja-Jośko, M. Kołakowski, J. Cichocki: „Podsystem lokalizacyjny w platformie IONIS” (IONIS Platform Localization Subsystem), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVI, no. 6, 2017, pp. 493--496.

[Pub61] M. Kołakowski: „Wykorzystanie pomiarów przyspieszenia do zwiększenia dokładności wyznaczania położenia w ultraszerokopasmowym systemie lokalizacyjnym” (Using Acceleration Measurements to Improve Ultra-Wideband Positioning System Accuracy), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXX XVI, no. 6, 2017, pp. 433-436.

[Pub62] T. Kosiło, K. Radecki, J. Marski: „NB IOT nowy wąskopasmowy standard telefonii komórkowej dla Internetu rzeczy” (NB IoT - New Narrowband Cellular Standard for the Internet of Things Applications), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVI, no. 6, 2017, pp. 263-266.

[Pub63] J. Kryszyn, W. Smolik: “Toolbox for 3D Modelling and Image Reconstruction in Electrical Capacitance Tomography”, *Informatyka Automatyka Pomiary w Gospodarce i Ochronie Środowiska*, no. 1, 2017, pp. 137-145.

[Pub64] J. Kryszyn, W. Smolik: “2D Modelling of a Sensor for Electrical Capacitance Tomography in Ectsim Toolbox”, *Informatyka Automatyka Pomiary w Gospodarce i Ochronie Środowiska*, no. 1, 2017, pp. 146-149.

[Pub65] J. Kryszyn, W. Smolik, T. Olszewski, R. Szabatin: „Development of Electrical Capacitance Tomograph Desgn in the Nuclear and Medical Electronics Division”, *Informatyka Automatyka Pomiary w Gospodarce i Ochronie Środowiska*, no. 1, 2017, pp. 111-114.

[Pub66] M. Mikołajewski: „Optymalizacja układu sterującego w rezonansowym wzmacniaczu w.cz. klasy E” (Optimization of a Rectangle Wave Gate Driver in Class E Amplifier), *Przegląd Elektrotechniczny*, no. 8, vol. 93, 2017, pp. 31-34.

[Pub67] P. Piasecki, Y. Yashchyshyn: „Badanie anteny z falą wyciekającą wykonanej w technologii LTCC pracującej w zakresie 125 GHz - 135 GHz” (Measurements of a LTCC Leaky Wave Antenna Operated in 125 GHz - 135 GHz), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVI, no. 6, 2017, pp. 267-270.

[Pub68] D. Radomski, K. Kruszewski: „An Application of a Dynamic Thermography for Sudying a Relation Between Thermal and Mechanical Activities of a Skeletal Muscle During a Static Load”, *Measurement Automation Monitoring*, vol. 63, no. 4, 2017, pp. 139-142.

[Pub69] J. Sobolewski, B. Synkiewicz, P. R. Bajurko: „Antena łatkowa na pasmo 120 GHz w bezskurczowej technologii LTCC" (120 GHz Patch Antenna in a Zero Shrinkage LTCC Technology), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVI, no. 6, 2017, pp. 271-274.

[Pub70] W. Smolik, J. Kryszyn: „Linear over Ranges Iterative Algorithms for Image Reconstruction in Electrical Capacitance Tomography", *Informatyka Automatyka Pomiary w Gospodarce i Ochronie Środowiska*, no. 1, 2017, pp. 115-120.

[Pub71] W. Smolik, J. Kryszyn, T. Olszewski, R. Szabatin: „Methods of Small Capacitance Measurement in Electrical Capacitance Tomography", *Informatyka Automatyka Pomiary w Gospodarce i Ochronie Środowiska*, no. 1, 2017, pp. 105-110.

[Pub72] A. Strupczewski: „System do śledzenia wzroku w warunkach codziennych" (Eye Gaze Tracking in the Wild), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVI, no. 6, 2017, pp. 601--606

[Pub73] B. Synkiewicz, D. Szwagierczak, W. Grzesiak, J. Ratajczak, J. Kulawik, Y. Yashchyshyn, P. Bajurko: „Zastosowanie technologii LTCC w wytwarzaniu podłoży do układów mikrofalowych" (Application of LTCC Technology for Fabrication of Substrates for Microwave Devices), *Elektronika: Konstrukcje, Technologie, Zastosowania*, vol. 58, no. 9, 2017, doi: 10.15199/13-2017.9.6, pp. 21-24.

[Pub74] M. Wieteska, W. Obrębski, E. Piątkowska--Janko, B. Sawionek, P. Bogorodzki: „Increasing the Signal to Noise Ratio in Low--Field MR Scanner at Depatment of Nuclear and Medical Electronics", *Informatyka Automatyka Pomiary w Gospodarce i Ochronie Środowiska*, no. 1, 2017, pp. 133-136.

[Pub75] P. Wróblewski, W. Smolik: „Development of Magnetic Nanoparticles Tomography in Nuclear and Medical Electronics Division", *Informatyka Automatyka Pomiary w Gospodarce i Ochronie Środowiska*, no. 1, 2017, pp. 125-129.

[Pub76] P. Wróblewski, W. Smolik: "Coil Design with Litze Wire for Magnetic Particle Spectrometry", *Informatyka Automatyka Pomiary w Gospodarce i Ochronie Środowiska*, no. 1, 2017, pp. 150-153.

[Pub77] J. Żera: "Akustyka a multimedia" (Acoustics versus Multimedia), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXVI, no. 6, 2017, pp. 177-184.

[Pub78] K. Mroczek: "An Universal USB 3.0 FIFO Interface for Data Acquisition", *Measurement Automation Monitoring*, vol. 62, no. 12, Dec. 2016, pp. 434-438.**

** Paper indicated on this subsection as [Pub70] has not been published in the Annual Report 2016.

6.2.3. Other journals

[Pub79] P. Kossakowski, P. Bilski: "Analysis of the Self-Organizing Map-Based Investment Strategy", *International Journal of Computing*, vol. 16, issue 1, 2017, pp. 10-17.

[Pub80] M. Leszczyński, D. Levselenko, P. Paczuski, P Miazga: „Projekt Algochecker - skalowana platforma na bazie Dockera do automatycznego testowania programów" Algochecker Project - Docker-Based Scalar Platform for Automatic Testing of Programs), *Programista,* no. 4, 2017*,* pp. 32--41.

6.2.4. Publications on general aspects of science, technology and education

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P. Bilski, F. Guerriero (eds.), *Computer Systems for Healthcare and Medicine, River Publishers*, 2017, ISBN: 978-87-93519-31-2, 292 pp.

7. RESEARCH REPORTS

[Rep1] J. Modelski, J. Cichocki, A. Buchowicz, K. Kurek, T. Krzymień, W. Wojtasiak: *„Usługi konsultingowe w zakresie audytu systemów telekomunikacyjnych"* (Expertise on Consulting Service for Telecommunication Systems), Final report for EMITEL LTd., Warsaw, Feb. 2017.

[Rep2] D. Gryglewski, W. Wojtasiak, P. Korpas, D. Rosołowski: *„Opracowanie oraz wykonanie anten nadawczych i wzmacniaczy do demonstratora szumowego"* (Elaboration and Construction Transmitting Antena for Noise Demonstartor), Final report for the Institute of Electronic Systems, Faculty of Electronics and Information Technology WUT, Warsaw, Nov. 2017.

[Rep3] W. Gwarek, P. Kopyt: *„Promieniowanie i optymalizacja detektorów promieniowania sub-THz zbudowanych w oparciu o tranzystory MOS"* (Design and Optimization of Radiation Detectors Sub-THz based on MOS Transistors), Final report for the National Science Center, Warsaw, Mar. 2017.

[Rep4] K. Ignasiak, W. Skarbek, G. Pastuszak, A. Buchowicz, G. Galiński, J. Naruniec, A. Abramowski, M. Trochimiuk, G. Gwardys, D. Grzywczak M. Kowalski: *„Inteligentne, sieciowe systemy wielokamerowe"* (Audiovisual Networked Hybrid Systems), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2017.

[Rep5] J. Kołakowski, J. Cichocki, R. Michnowski, K. Radecki, V. Djaja-Jośko, M. Kołakowski: *„Wykorzystanie metod odometrycznych do weryfikacji właściwości systemów radiolokalizacyjnych"* (Application of Odometry Technique for Radio Positioning Systems Evaluation), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2017.

[Rep6] P. Korpas: *„Bezprzewodowa transmisja danych wideo do hełmów wirtualnej rzeczywistości (VR)"* (Wireless Video Data Transmission to Virtual Reality Headset), Final report for the Dean grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Dec. 2017.

[Rep7] K. Kurek: *"Budowa mobilnej stacji naziemnej do odbioru danych APRS z balonów stratosferycznych"* (Realization of Mobile Ground Station for Reception of APRS Data from Stratospheric Ballons), Final report for the Rector grant, WUT, Warsaw, Dec. 2017.

[Rep8] J. Marzec, K. Zaremba, P. Bogorodzki, P. Brzeski, G. Domański, M. Dziewiecki, T. Jamrógiewicz, B. Konarzewski, R. Kurjata, 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: *„Zaawansowane techniki elektroniki jądrowej i medycznej"* (Advanced Techniques in Nuclear and Medical Electronics), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2017.

[Rep9] J Modelski, K. Kurek, T. Truszczyński: *„Nowe techniki transmisji w systemach satelitarnych"* (New Transmission Techniques in Satellite Systems), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2017.

[Rep10] P. Miazga: *„Metoda elektromagnetyczna estymacji stopnia penetracji propantu w procesie szczelinowania"* (Electromagnetic Method of Estimating the Degree of Penetration in the Proces of Propant Fracturing), Final report for the National Centre for Research and Development, Nov. 2017.

[Rep11] M. Mikołajewski, H. Chaciński, W. Kazubski, J. Modzelewski: *„Optymalizacja układów i konstrukcji rezonansowych wzmacniaczy mocy klasy E o częstotliwościach roboczych w zakresie 10 MHz – 100 MHz"* (Optimisation of Class E Resonant Amplifiers in the Frequency Range 10-100 MHz), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2017.

[Rep12] R. Z. Morawski, A. Miękina, A. Podgórski: *„Interpretacja danych empirycznych i jej kontekst meta-naukowy"* (Interpretation of Empirical Data and its Meta-Metrological Context), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2017.

[Rep13] G. Pastuszak: *„Opracowanie oraz wykonanie zestawu prototypów przemienników sygnału HD"* (Design and Implementation of HD-Signal-Converters Prototypes), Final report for CAMSAT Gralak Przemysław, Warsaw, Dec. 2017.

[Rep14] P. Płoński: *„Konwolucyjne sieci neuronowe z dynamicznym doborem architektury"* (Wireless Video Data Transmission to Virtual Reality Headset) Final report for the Dean grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Dec. 2017.

[Rep15] A. Rychter: *„Badanie charakterystyki widmowej nowych typów półprzewodnikowych detektorów światła z Geigerowskim powielaniem elektronowym"* (Investigation of Spectral Characteristics of New Types of SIPM Detectors), Final report for the Dean grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Dec. 2017.

[Rep16] B. Salski, P. Kopyt: „Opracowanie ekspertyzy dotyczącej skutecznej powierzchni odbicia wybranych konstrukcji lotniczych" (Expertise on Radar Cross-Section of Selected Aircrafts), Final report for AM Technologies Ltd., Warsaw, Nov. 2017.

[Rep17] K. Snopek, S. Kozłowski, A. Bilski, Ł. Błaszczyk: *„Analizy teoretyczne i symulacje komputerowe algorytmów przetwarzania sygnałów w systemach radiokomunikacyjnych"* (Signal Processing Algorithms in Radiocommunication Systems - Theoretical Studies and Computer Simulations), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2017.

[Rep18] W. Winiecki, P. Bilski, R. Łukaszewski, K. Mroczek, A. Wójcik, K. Dowalla: *„Rozwój algorytmów i urządzeń do monitoringu i diagnostyki urządzeń elektrycznych i systemów analogowych"* (Development of Algorithms and Devices for Monitoring and Diagnostics of Electrical Devices and Analog Systems), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2017.

[Rep19] W. Wojtasiak, S. Rosłoniec, B. Salski, M. Celuch, D. Rosołowski, D. Gryglewski, P. Kopyt, P. Korpas, P. Miazga, M. Sypniewski, M. Krysicki, M. Góralczyk, D. Kuchta, T. Karpisz, M. Lubiejewski: *„Projektowanie urządzeń mikrofalowych i optoelektronicznych wspomagane modelowaniem pól elektromagnetycznych z uwzględnieniem sprzężonych zjawisk fizycznych"* (Microwave and Optoelectronic Devices Design Using Electromagnetic Modelling with Account of the Coupled Physical Effects), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2017.

[Rep20] W. Wojtasiak, D. Gryglewski, P. Korpas, D. Rosołowski: *„Udostępnienie mikrofalowej aparatury pomiarowej: analizatora sieci, miernika mocy do przeprowadzenia badań i pomiarów"* (Microwave Measuring Apparatus: Network Analyzer, Power Meter for Testing and Measurement), Final report for Qwed Ltd., Warsaw, May 2017.

[Rep21] Y. Yashchyshyn, G. Bogdan, K. Godziszewski: *"28-GHz konfiguracja kształtowania wiązki oparta na diodach PIN"* (28-GHz Reconfigurable Beamforming Antenna Based on PIN Diodes), Final report for Electronics and Telecommunications Research Institute, Republic of Korea (Instytut Elektroniki i Telekomunikacji Republiki Korei), Warsaw, Jan. 2017

[Rep22] Y. Yashchyshyn, G. Bogdan, K. Godziszewski: *"Rekonfigurowalna antena z kształtowaniem wiązki na bazie przełączników półprzewodnikowych oraz modulacji czasowej"* (Reconfigurable Beamforming Antenna with Semiconductor Switches and Time-Modulated Antenna Array), Final report for Electronics and Telecommunications Research Institute, Republic of Korea (Instytut Elektroniki i Telekomunikacji Republiki Korei), Warsaw, Nov. 2017.

[Rep23] Y. Yashchyshyn, P. Bajurko K. Derzakowski, K. Godziszewski, G. Bogdan, D. Nyzovets, P. Piasecki: *„Badanie anten z modulacją czasową"* (Investigations of Time Modulated Antenna Arrays), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, WUT, Warsaw, Nov. 2017.

[Rep24] K. Zaremba, J. Marzec. M. Dziewiecki, G. Domański, B. Konarzewski, R. Kurjata, M. Ziembicki, A. Rychter, P. Płoński: *„T2K – eksperyment neutrinowy drugiej generacji"* (The T2K Neutrino Second Generation Experiment), Final report for the National Science Center, Warsaw, Jun. 2017.

[Rep25] J. Żera, P. Bilski, G. Makarewicz, A. Pietrzak, M. Lewandowski: *"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, Nov. 2017.

[Rep26] J. Żera, G. Makarewicz: *„Wykonanie pomiarów hałasu środowiskowego w zabudowie jednorodzinnej"* (Measurement of Environmental Noise in Detached House), Final report fo Doradztwo Energetyczne Jerzy Majcher Ltd., Warsaw, Sept. 2017.

[Rep27] J. Żera: *„Udostępnienie komory bezechowej"* (Use of the Anechoic Chamber), Final report for by Peter Siedlaczek Ltd., Warsaw, Oct. 2017.

[Rep28] J. Żera: *„Badania akustyczne Filharmonii Pomorskiej im. Ignacego Jana Paderewskiego w Bydgoszczy"* (Acoustic Measurement for the Ignacy Jan Paderewski Pomeranian Philharmonic in Bygdoszcz), Final report for Manufaktura Technologiczna Ltd., Warsaw, Oct. 2017.

8. PATENTS

[Pat1] P. Bajurko: *"Antena tubowa diagonalna"* (Diagonal horn antenna), Polish patent, application number P.413078, application date Jul. 09, 2017, date of grant Dec. 07, 2017.

[Pat2] P. Bajurko, M. Bury, S. Kozłowski: *„Mikrofalowy system pomiarowy z oknowaniem w czasie"* (Microwave measurement system with time gating), Polish patent, exclusive right number PL 227828, application number P.399175, application date May 15, 2012, date of grant Jun. 23, 2017.

[Pat3] P. Bajurko, M. Bury, S. Kozłowski: *„Impulsowy system pomiarowy do wyznaczania parametrów sterowanych układów mikrofalowych"* (Pulse measurement system for determining the parameters of steerable microwave circuits), Polish patent, exclusive right number PL 227869, application number P.398249, application date Feb. 27, 2012, date of grant Aug. 22, 2017.

[Pat4] M. Bury, R. Zawiślak, S. Kozłowski, P. Bajurko: *"Antena o przełączanej polaryzacji"* (Antenna with switchable polarization), Polish patent, exclusive right number PL 226960, application number P-398059, application date Feb. 09, 2017, date of grant Apr. 25, 2017, publication date (in WUP) Oct. 31, 2017.

[Pat5] M. Bury, P. Bajurko, S. Kozłowski: *„Mikrofalowy wielkonanałowy system pomiarowy z przetwarzaniem w dziedzinie czasu"* (Time-domain microwave multichannel measurement system), Polish patent, exclusive right numer PL 227561, application number P-396233, application date Sept. 5, 2011, date of grant Jun. 20, 2017.

9. SCIENTIFIC EVENTS

9.1. Scientific events co-organized by the Institute

[Con1] *8th Annual IEEE International Conference on RFID Technology and Applications: IEEE RFID-TA 2017* (Warsaw, Poland, Sept. 20-22, 2017), J. Modelski (general chair), P. Bilski (chair of the Technical Committee), J. Kołakowski, V. Djaja-Jośko, M. Kołakowski (speakers), conference has been organized in collaboration with the Insitute of Logistics and Warehousing, Poznań, Poland.

9.2. International scientific events

[Con2] *The IMS 2017 TPRC Meeting* (Phoenix, USA, Jan. 13-16), P. Kopyt (member of the Technical Committee).

[Con3] *10th International Joint Conference on Biomedical Engineering Systems and Technologies: BIOSTEC 2017* (Porto, Portugal, Feb. 21-23, 2017), P. Mazurek (speaker).

[Con4] *11th European Conference on Antennas and Propagation: EuCAP 2017 (*Paris, France, Mar. 19-24, 2017), P. Bajurko (speaker).

[Con5] *7th International Workshop on Magnetic Particle Imaging* (Prague, Czech Republic, Mar. 22-26, 2017), D. Wanta (participant).

[Con6] *XII Międzynarodowa Konferencja Naukowa Elektroniki i Telekomunikacji Studentów i Młodych Pracowników Nauki (*XIIth International Electronics and Telecommunication Conference of Students and Young Scientists: SECON 2017) (Warsaw, Apr. 20-21, 2017), M. Kołakowski, V. Djaja-Jośko (speakers).

[Con7] *The Summer XLth IEEE-SPIE Joint Symposium on Photonics, Web Engineering, Electronics for Astronomy and High Energy Physics Experiments* (Wilga, Poland, May 29-Jun. 4, 2017), T. Filipek, R. Pilarczyk, R. Protasiuk, A. Wójcik (speakers).

[Con8] *15th IMEKO TC10 Workshop on Technical Diagnostics: Technical Diagnostics in Cyber-Physical Era* (Budapest, Hungary, Jun. 6-7, 2017), P. Bilski (speaker).

[Con9] *International Microwave Symposium: IMS 2017* (Honolulu, Hawaii, USA, Jun. 4-9, 2017), J. Modelski (participant).

[Con10] *173rd Meeting of the Acoustical Society of America and the 8th Forum Acusticum* (Boston, USA, Jun. 25-29, 2017), J. Żera (speaker).

[Con11] *2017 IEEE International Conference on Computational Intelligence and Virtual Environments for Measurement Systems and Applications (CIVEMSA)* (Annecy, France, Jun. 26-28, 2016), P. Mazurek (speaker).

[Con12] *The European Conference Physics of Magnetism: PM'17* (Poznań, Poland, Jun. 26-30, 2017), P. Kopyt, B. Salski (participants).

[Con13] *40th International Conference on Telecommunications and Signal Processing: TSP 2017* (Barcelona, Spain, Jul. 5-7, 2017), K. Snopek (session chairman, speaker).

[Con14] *International Travelling Summer School on Microwaves and Lightwaves (ITSS) in conjunction with the 2nd Summer School of the ITN CELTA* (Stockholm, Sweden, Jul. 8-15, 2017), Y. Yashchyshyn (speaker), D. Nyzovets (participant).

[Con15] *2017 IEEE Conference on Computer Vision and Pattern Recognition (CVPR)* (Honolulu, Hawaii, USA, Jul. 21-26, 2017), M. Kowalski (speaker).

[Con16] *XXXIInd URSI General Assembly and Scientific Symposium: URSI GASS 2017* (Montreal, Canada, Aug. 19-23, 2017), J. Modelski (Polish representative at the General Assembly).

[Con17] *International Conference 'Advanced Mathematical and Computational Tools in Metrology and Testing XI' – AMCTM 2017* (Glasgow, UK, Aug. 28-Sept. 2017), P. Mazurek, J. Wagner (speakers).

[Con18] *The Second International Conference on Information and Telecommunication Technologies and Radio Electronics: UkrMico 2017* (Odessa, Ukraine, Sept. 10-16, 2017), Y. Yashchyshyn (session chairman, speaker).

[Con19] *2017 Signal Processing Symposium (SPSympo)* (Jachranka village, Poland, Sept. 12-14, 2017), V. Djaja-Jośko,

[Con20] *18th International Symposium on Electromagnetic Fields in Mechatronics, Electrical and Electronic Engineering* (Łódź, Poland, Sept. 14-16, 2017), J. Modelski: invited lecture 'Terahertz Radioelectronics – Expectations, Possibilities and Limitations' co-author: Y. Yashchyshyn.

[Con21] *European Material Research Society Fall Meeting: E-MRS 2017* (Warsaw, Poland, Sept. 18-21), Y. Yashchyshyn (speaker).

[Con22] *IEEE Signal Processing, Algorithms, Architectures, Arrangements, and Applications: SPA 2017* (Poznań, Poland, Sept. 20-22, 2017), Z. Kulka, J. Modelski, W. Skarbek (members of the Scientific Committee).

[Con23] *The 9th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications: IDAACS 2017* (Bucharest, Romania, Sept. 21-23, 2017), W. Winiecki, P. Bilski, A. Wójcik (speakers).

[Con24] *9th Kraków Workshop on Novel Applications of Imaging and Spectroscopy in Medicine, Biology and Material Sciences* (Kraków, Poland, Sept. 21-23, 2017), P. Bogo-

rodzki, E. Piątkowska-Janko, K. Radecki, G. Bogdan, W. Obrębski, M. Wieteska, P. Wróblewski (speakers).

[Con25] *European Microwave Week 2017* (Nürnberg, Germany, Oct. 8-13, 2017), J. Modelski (sessions chair, member of the Technical Programme Committee), M. Góralczyk (speaker).

[Con26] *Workshop DAQ/FEE/Trigger for COMPASS beyond 2020* (Prague, Czech Republic, Oct. 9-11, 2017), R. Kurjata, A. Rychter (participants).

[Con27] *44th International Conference and Exhibition PIKE 2017* (44 Międzynarodowa Konferencja i Wystawa PIKE 2017) (Poznań, Poland, Oct. 9-12, 2017), J. Modelski (chair of the Programme Council).

[Con28] *XVII Międzynarodowe Sympozjum Inżynierii i Reżyserii Dźwięku: ISSET 2017* (XVIIth International Symposium on Sound Engineering and Tonmeistering) (Warsaw, Poland, Oct. 13-15, 2017), J. Żera (session chair), M. Lewandowski, G. Makarewicz, A. Pietrzak (speakers).

[Con29] *International Conference on Computer Vision: ICCV 2017* (Venice, Italy, Oct. 22-29, 2017), J. Naruniec, M. Kowalski (participants).

[Con30] *4th European Workshop on Non-Intrusive Load Monitoring: NILM 2017* (London, UK, Nov. 6-7, 2017), P. Bilski (speaker).

[Con31] *25th Telecommunications Forum: TELFOR 2017* (Belgrade, Serbia, Nov. 21-22, 2017), J. Kołakowski, V. Djaja-Jośko, M. Kołakowski (speakers).

9.3. National scientific events

[Con32] *VI Interdyscyplinarne Warsztaty Matematyczne* (VIth Interdisciplinary Mathematical Workshop) (Będlewo, Poland, May 12-14, 2017), Ł. Błaszczyk (participant).

[Con33] *Human and Field: Submission or Interaction/AIDI and CAS WUT Symposium* (Steryń, Poland, May 19-21, 2017), P. Bilski (member of the Scientific Committee), P. Bogorodzki, G. Domański, M. Wieteska (plenary speakers).

[Con34] *Krajowa Konferencja Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2017* (National Conference on Radiocommunications and Broadcasting) (Poznań, Poland, Jun. 21-23, 2017), J. Cichocki W. Skarbek, Y. Yashchyshyn (members of the Program Committee), J. Modelski (chairman of the plenary session, member of the Program Committee), J. Żera (plenary lecturer), P. Bajurko, P. Bobiński, J. Kołakowski, W. Kazubski, T. Kosiło, R. Michnowski, K. Radecki, B. Salski G. Bogdan, K. Godziszewski, P. Hoffmann, M. Kołakowski, P. Korpas, P. Buczkowski, V. Djaja-Jośko, P. Piasecki, J. Sobolewski (speakers).

[Con35] *LXIV Otwarte Seminarium z Akustyki: OSA 2017* (LXIVth Open Seminar on Acoustics) (Piekary Śląskie, Poland, Sept. 11-15, 2017), J. Żera (member of the Scientific Committee), G. Makarewicz, A. Pietrzak, B. Żłobiński (speakers).

[Con36] *XXXIII Krajowe Sympozjum Telekomunikacji i Teleinformatyki: KSTiT 2017* (Warsaw, Poland, Sept. 13-15, 2017), J. Modelski, W. Skarbek (members of the Program Committee), M. Kołakowski (speaker).

[Con37] *XX Krajowa Konferencja Naukowa Biocybernetyka i Inżynieria Biomedyczna* (XXth Polish Conference on Biocybernetics and Biomedical Engineering) (Kraków, Poland, Sept. 20-22, 2017), K. Zaremba (member of the Program Committe).

[Con38] *Konferencja: Termografia i Termometria w Podczerwieni* (Conference: Thermography and Infrared Thermometry) (Ustroń Jaszowiec, Poland, Sept. 27-29, 2017), D. Radomski (participant).

[Con39] *9 Konferencja Urządzenia i Systemy Radioelektroniczne: UISR'17* (Conference on Radioelectronics Devices and Systems) (Jachranka, Poland, Nov. 14-16, 2017), J. Modelski (member of the Program Committee).

[Con40] *XVIII Seminarium – Radiokomunikacja i Techniki Multimedialne* (XVIIIth Seminar: Radiocommunications and Multimedia Technologies) (Warsaw, Poland, Dec. 6, 2017), J. Naruniec, V. Djaja-Jośko, M. Kołakowski, J. L. Pach, A. Pacewicz, A. Pietrzak, J. Cuper, M. Nowak, R. Świerbutowicz, K. Yuksel (speakers).

10. AWARDS AND DISTINCTIONS

State Medals

Złoty Krzyż Zasługi (Golden Cross of Merit).
Karol Radecki, Ph.D.

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

Medal Komisji Edukacji Narodowej (Medal of the National Education Committee).
Janusz Marzec, D.Sc., Prof.

Awards granted by international bodies

Certificate of Appreciation for the outstanding service for the *TSP 2017* Conference Technical Committee as a chairman of session.
Kajetana M. Snopek, D.Sc.

Awards granted by national bodies

'Polish Congress Ambassador' title granted by Polish Tourist Organization and Polish Conference and Congress Association for his individual relation to organization of international conferences in Poland.
Józef Modelski, Prof. D.Sc.

Service Award 2017 granted by IEEE Poland Section
Andrzej Miękina, Ph.D.

The first award in Best M.Sc. Diploma National Competition granted by the Polish Association of Telecommunication Engineers
Marcin Kołakowski, M.Sc.

Awards of the Rector

Team I° award for the organizational achievements.
Józef Modelski, Prof. D.Sc.,
Bartłomiej Salski, D.Sc.,
Anna Czarnecka, M.Sc.

Individual II° award for the organizational achievements.
Krzysztof Zaremba, Prof. D.Sc.

Individual III° awards for the organizational achievements.
Wiesław Winiecki, Prof. D.Sc.,
Marek Krawczyk, Prof. M.D. Ph.D.

Individual III° award for the scientific achievements.
Piotr Bilski, D.Sc. Prof.

Individual III° award for the didactic achievements.
Grzegorz Domański, Ph.D.

Team I° award for the organizational achievements.
Roman Z. Morawski, Prof. D.Sc.

Individual III° awards granted for the Ph.D. theses.
Przemysław Korpas, Ph.D.,
Piotr Płoński, Ph.D.

Team I° award for the scientific achievements.
Wojciech Gwarek, Prof. D.Sc.,
Bartłomiej Salski, D.Sc.,
Paweł Kopyt, D.Sc.

Team II° award for the scientific achievements.
Roman Z. Morawski, Prof. D.Sc.,
Wiesław Winiecki, Prof. D.Sc.,
Yevhen Yashchyshyn, Prof. D.Sc.,
Andrzej Miękina, Ph.D.,
Paweł Bajurko, Ph.D.,
Paweł Mazurek, M.Sc.,
Jakub Wagner, M.Sc.

Awards of the students of the Faculty

"Golden Chalk" Awards.
Jacek Naruniec, Ph.D.,
Mateusz Krysicki, M.Sc.

Award of the Foundation for the Development of Radiocommunications and Multimedia Technologies in the Young Authors' competition

The first award in the Young Authors' Competition for the paper titled: *"„Antena łatkowa na pasmo 120 GHz w bezskurczowej technologii LTCC*" (120 GHz Patch Antenna in a Zero Shrinkage LTCC Technology), *Krajowa Konferencja Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2017* (National Conference on Radiocommunications and Broadcasting) (Poznań, Poland, Jun. 21-23, 2017).
Jakub Sobolewski, M.Sc.

The distinguished paper titled: *„Badanie anteny z falą wyciekającą wykonanej w technologii LTCC pracującej w zakresie 125 GHz - 135 GHz"* (Measurements of a LTCC Leaky Wave Antenna Operated in 125 GHz - 135 GHz), *Krajowa Konferencja Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2017* (National Conference on Radiocommunications and Broadcasting) (Poznań, Poland, Jun. 21-23, 2017).
Przemysław Piasecki, M.Sc.

Award granted for the Ph.D. students.

For winning 3rd place in Best Paper Competition in Young Scientists Group at *XII*th *International Electronics, Telecommunication and Energetics Conference of Students and Young Scientists: SECON 2017.*
Marcin Kołakowski, M.Sc.

Special Award at *XII*th *International Electronics, Telecommunication and Energetics Conference of Students and Young Scientists: SECON 2017.*
Vitomir Djaja-Jośko, M.Sc.

The award for the best paper at IIIrd Conference on WUT Student Research Groups.
Adam Pacewicz, M.Sc.
Jerzy Cuper

Award of the Faculty of Electronics and Information Technology, WUT in the Ph.D. students' competition

Award for the Ph.D. thesis: *"Commodity Camera Eye Gaze Tracking".*
Adam Strupczewski, Ph.D.

Scholarships of the Foundation for the Development of Radiocommunications and Multimedia Technologies granted in 2017

For preparing Ph.D. Thesis
Jakub Leszek Pach

For preparing M.Sc. Thesis
Yuksel Kivanc
Filip Kulpa
Marta Nowak
Adam Pacewicz
Rafał Świerbutowicz

For preparing B.Sc. Thesis
Jerzy Cuper

11. STATISTICAL DATA (as of Dec. 31st of each year)

SPECIFICATION	2014	2015	2016	2017
academic staff [posts] total	60,68	60,23	63,58	60,33
tenured professors	6	5,5	5,5	4,5
professors	5,5	5,5	8,5	9,5
associate professors	2,75	5	3	2
assistant professors	37,90	33,65	32,25	29,5
readers	1	1	1	1
senior lecturers	4,53	4,08	5,33	4,33
assistants	3	5,5	8	9,5
Ph.D. students [persons] total	39	45	38	37
with scholarship	28	34	31	23
without scholarship	11	11	7	14
technical and administrative staff [posts] total	17,25	17,75	16,75	15,5
senior R&D associates	1,25	1,25	1	1
R&D associates	5,5	5	5	4
administrative associates	9,5	9,5	8,75	8,5
service workers	1	2	2	2
temporary staff	0	0	2	2
library resources books (volumes)	11181	11197	11212	11212
books (titles)	7292	7307	7323	7323
journals (subscribtions)	83	83	83	83
teaching activities basic courses	61	61	62	63
advanced courses	35	34	30	28
other courses	47	47	50	38
international projects, courses and lectures	3	4	1	1
research projects total	46	48	50	50
international	6	3	3	3
granted by the Ministry	22	21	19	17
granted by the University	11	17	15	14
other	7	8	13	16
titles and degrees awarded Prof. titles	0	0	1	1
D.Sc. degrees	3	3	0	1
Ph.D. degrees	5	5	7	2
M.Sc. degree (regular studies + evening studies)	62+2	63+2	48+1	48+1
M.Sc. degree (studies in English)	1	1	1	3
B.Sc. degrees (regular studies + evening studies)	98+4	69+5	72+7	80+2
B.Sc. degrees (studies in English)	2	2	0	2
B.Sc. degrees e-learning	2	2	3	1
publications total	215	205	208	149
sci.-tech. books and chapters in books	8	2	2	7
sci.-tech. papers in journals - total	83	89	66	73
JCR-ICI list (IF>0)	44	33	37	40+1*
MSHE list	36	52	28	30+1*
in other journals	3	4	9	3
sci.-tech. papers in conference proceedings	83	81	107	55
other publications	41	33	24	11
patents	2	3	4	5
international	1	1	1	0
national	1	2	3	5
research reports	19	24	21	28
scientific events attended by the staff	46	42	41	40

*these papers have been published in December 2016, and not indicated on the previous issue.

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 from 2005 (with further addendmends)