INSTITUTE OF RADIOELECTRONICS AND MULTIMEDIA TECHNOLOGY

WARSAW UNIVERSITY OF TECHNOLOGY

FACULTY OF ELECTRONICS AND INFORMATION TECHNOLOGY

ANNUAL REPORT

2018

Warsaw, January 2019

From the Director

Welcome to the 2018 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 have been introduced by the Government. The reform, which the academic community demanded for years, is aimed at creating the best conditions for the development of Polish science as well as formation of the future staff. The introduced changes are aimed at academic research, student teaching and university management. The process is subordinate to the education of future elites. A new model of doctoral education has been provided - doctoral schools, scholarships for each PhD student and new solutions aimed at improving the quality of doctoral dissertations. The reform is to ensure stability of employment and development of academic and scientific careers by creating a new path for eminent didactics, facilitating the process of obtaining habilitation for outstanding scholars. Moreover, new regulations provide the university with opportunity to create its own academic career paths. The important aspect of the new reform is the introduction the scientific activity evaluation - the whole university will be assessed based on disciplines. For this reason a new classification of disciplines and their adaptation to foreign standards has been introduced. The important element of evaluation is the departure from "point-based" system to the quality expressed by something more than the number of publications. For this reason the intensification of scientific research, improving quality of the education process and increasing participation in international projects will be more important. It should be noted that in previous years the Institute established complex infrastructure, making upgrade to the higher research level possible.
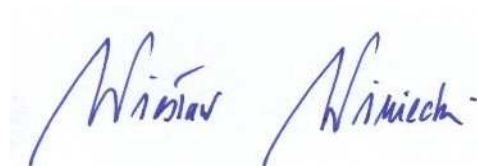
Also, in 2018 the implementation of the NERW PW (Knowledge-Education-Development-Cooperation) project began. It is aimed at supporting the development of the Warsaw University of Technology by the European Commission through the National Centre of Research and Development and will last until 2022, covering various activities to modernize the education process at the University. Our Institute participates in several tasks of this project, two of them being associated with the development of new specializations of Telecommunications and Biomedical Engineering. These tasks are coordinated by our Institute staff. Significant changes in the Biomedical Engineering study program have already been introduced in the current academic year. The implementation of the new Telecommunications program is scheduled for October 2019.

The statistical analysis confirms we are heading in the right direction as the total number of publications year-by-year significantly increased in 2018, with 33 articles published in journals from the JCR list and 6 patents granted. We should definitely keep it up in 2019!

The measure of the teaching staff quality are numerous awards. It is a real pleasure to see Golden Chalk prize granted by the Faculty students to our colleague, M.Sc. Mateusz Krysicki. We are strongly convinced that such an achievement will additionally contribute to the inflow of talented students selecting 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 (Dr Krzysztof Derzakowski and Dr Maciej Sypniewski). Two members of our staff have received highly prestigious awards: Medal of National Education Committee for Prof. Yevhen Yashchyshyn and Prof. Jan Żera. Also, four students received their PhD degrees, 10 degrees and 3 BSc degrees were received with honours.

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 2019   Professor Wiesław Winiecki

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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 neuroimag-

ing, 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

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  e-mail: A.Tratkiewicz@ire.pw.edu.pl

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Secretariat

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Deputy Director for Academic Affairs

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Director's Representative for Economy & Administration

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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

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Senior academic staff

Wiesław Winiecki, Prof. D.Sc.,

Piotr Bilski, D.Sc., Professor

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

Agnieszka Pietrzak, M.Sc., Assistant

Technical staff

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

Ph.D. Students

Jonatan Borkowski, M.Sc., from Oct. 2018

Krzysztof Dowalla, M.Sc., from Feb. 2017

Maciej Jasiński, M.Sc., from Feb. 2018

Jacek Majer, M.Sc., from Oct. 2018

Tomasz Markowski, M.Sc., from Feb. 2018

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

Katarzyna Wynimko, M.Sc., from Oct. 2018

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 re-

search 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

Paweł Kopyt, D.Sc., Associate Professor

Bartłomiej Salski, D.Sc., Associate Professor

Daniel Gryglewski, Ph.D., Assistant Professor

Przemysław Korpas, Ph.D., Assistant Professor

Dawid Rosołowski, Ph.D., Assistant Professor

Maciej Sypniewski, Ph.D., (Assistant Professor till Oct. 2018, Senior Lecturer from Nov. 2018)

Przemysław Miazga, Ph.D. (Assistant Professor till Sept. 2018, Senior Lecturer from Oct. 2018)

Junior academic staff

Mateusz Krysicki, M.Sc., Research Assistant (from Feb. 2018)

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 Pacewicz, M.Sc., from Oct. 2017

Adam Raniszewski, M.Sc., from Feb. 2015

Temporary Staff

Dariusz Kołodziej, M.Sc., R&D Engineer (0.5, from Mar. 2018)

Marcin Piasecki, Ph.D., R&D Engineer (0.5, till Dec. 2018)

Retired

Wojciech Gwarek, Prof. D.Sc.,

Tadeusz Morawski, Prof. D.Sc.,

Stanisław Rosłoniec, 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 2018 included: design of Front-Ends for wireless systems, radar applications (oscillators, synthesizers, modulators, amplifiers, transmitter/receiver mod-

ules), 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

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Senior academic staff

Krzysztof Zaremba, Prof. D.Sc., Tenured Professor

Marek Krawczyk, Prof. M.D. Ph.D. (0.5, till May 2018)

Piotr Bogorodzki, D.Sc., Professor

Waldemar Smolik, D.Sc., 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 (till Jan. 2018)

Dariusz Radomski, Ph.D., Research Assistant Professor

Tymon Rubel, Ph.D., Assistant Professor

Andrzej Rychter, Ph.D., Assistant Professor

Piotr Brzeski, Ph.D., Senior Lecturer (0.5)

Tomasz Jamrógiewicz, M.Sc., Senior Lecturer (0.5, till Sept. 2018)

Tomasz Olszewski, M.Sc., Senior Lecturer

Junior academic staff

Robert Kurjata, Ph.D., Assistant

Jacek Kryszyn, Ph.D., Assistant

Jarosław Orzeł, M.Sc., Assistant (0.5, till Sept. 2018)

Wojciech Obrębski, M.Sc., Assistant (0.5)

Przemysław Wróblewski, M.Sc., Assistant (Dec. 2018)

Marcin Ziembicki, M.Sc., Assistant

Technical staff

Andrzej Wasilewski, Worker

Joanna Witkowska, Specialist (till Oct. 2018)

Ph.D. students

Monika Drabik, M.Sc. from Oct. 2016

Bartosz Kossowski, 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

Konrad Godziszewski, Ph.D., Assistant Professor

Wojciech Kazubski, Ph.D., Assistant Professor

Jerzy Kołakowski, Ph.D., Assistant Professor

Sebastian Kozłowski, Ph.D., Assistant Professor

Krzysztof Kurek, Ph.D., Assistant Professor

Mirosław Mikołajewski, Ph.D., Assistant Professor

Henryk Chaciński, M.Sc., Senior Lecturer (0.5, till Sept. 2018)

Tomasz Keller, Ph.D., Senior Lecturer (0.33, till Sept. 2018)

Junior academic staff

Grzegorz Bogdan, M.Sc., Assistant (0,5)

Vitomir Djaja-Jośko, M.Sc, Assistant (from Sept. 2017)

Denys Nyzovets, M.Sc., Research Assistant

Technical staff

Anna Czarnecka, M.Sc., Senior R&D Engineer (till Oct. 2018)

Ph.D. students

Grzegorz Bogdan, M.Sc., from Oct. 2013

Vitomir Djaja-Jośko, M.Sc., from Oct. 2015

Marcin Kołakowski, M.Sc., from Oct. 2016

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

Maciej Soszka, M.Sc., from Oct. 2018

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.

Henryk Chaciński, M.Sc

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

The most important research topics include analysis, development and investigation of:
- radiocommunication systems and networks – cellular

networks, 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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Senior academic staff

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

Grzegorz Pastuszak, D.Sc., Professor

Andrzej Buchowicz, Ph.D., Assistant Professor

Grzegorz Galiński, Ph.D., Assistant Professor

Andrzej Miękina, Ph.D., Assistant Professor

Jacek Naruniec, Ph.D., Assistant Professor

Andrzej Podgórski, Ph.D., (Assistant Professor till Sept. 2018, Senior Lecturer from Oct. 2018)

Krystian Ignasiak, Ph.D. (Assistant Professor till Sept. 2018, Senior Lecturer from Oct. 2018)

Tomasz Krzymień, M.Sc., Senior Lecturer (0.5, till Sept. 2018)

Junior academic staff

Paweł Mazurek, Ph.D., Assistant (0,5 from Oct. 2018)

Technical staff

Tomasz Krzymień, M.Sc., Senior R&D Engineer (from Oct. 2018).

Ph.D. students

Przemysław Buczkowski, M.Sc., from Oct. 2016

Daniel Grzywczak, M.Sc., from Feb. 2013

Grzegorz Gwardys, M.Sc., from Feb. 2013

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 (0.5, till Sept. 2018)
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1.5. Other Institute's Units

1.5.1 Library

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1.5.2 Accounting Department

Head

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Staff

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Aleksandra Jefimowicz, M.A.
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Beata Rosłon (from Sept. 2018)
room: 421, phone: +48 22 2347743
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Staff

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

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

Anna Czarnecka, M.Sc., Senior R&D Engineer (till Oct. 2018)
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e-mail: A.Czarnecka@ire.pw.edu.pl

2. STAFF

2.1. Senior academic staff

Paweł Bajurko
room: 34, phone: +48 22 2347795
e-mail: P.Bajurko@ire.pw.edu.pl
M.Sc. ('04), Ph.D. ('12); antennas and antenna arrays; reconfigurable systems, sub-THz techniques, wireless localization; **Assistant Professor**, Radiocommunications Division;
[Edu86]; [Pro3], [Pro12], [Pro13], [Pro30], [Pro41]; [MSc2]; [Pub37], [Pub68], [Pub136].

Piotr Bilski
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[Edu1], [Edu20], [Edu65]; [Pro29], [Pro32]; [MSc3]; [Pub14], [Pub36], [Pub58], [Pub64], [Pub65], [Pub144]; [Pat2], [Pat3], [Pat6], [Pat7].

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[Edu1], [Edu6], [Edu117]; [Pro32]; [MSc7], [MSc46]; [BSc18]; [Pub65],[Pub83], [Pub119]; [Pat2].

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[Edu79], [Edu116]; [Pro7], [Pro16], [Pro31], [Pro38], [Pro39], [Pro47]; [MSc37]; [BSc20], [BSc34]; [Pub17], [Pub30], [Pub41].

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[Edu7], [Edu8], [Edu21], [Edu116]; [Pro31], [Pro36], [Pro37], [Pro42]; [Pub40].

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[Edu56], [Edu93]; [Pro23]; [BSc17], [BSc51], [BSc81]; [Pub149].

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[Edu93]; [Pro26]; [BSc83].

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[Edu11], [Edu40], [Edu46], [Edu95], [Edu97], [Edu98], [Edu111], [Edu117]; [Pro9], [Pro10], [Pro24], [Pro44]; [BSc23], [BSc29].

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[Edu9], [Edu27]; [Pro12], [Pro30]; [BSc68]; [Pub147].

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[Edu48], [Edu116]; [Pro5], [Pro6], [Pro8], [Pro16], [Pro31]; [MSc13], [MSc18], [MSc20], [MSc21], [MSc36], [MSc40], [MSc47]; [BSc28], [BSc69]; [Pub2], [Pub40], [Pub41].

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[Pro1], [Pro5], [Pro6], [Pro8], [Pro31]; [Pub3], [Pub4], [Pub5], [Pub7], [Pub8], [Pub9], [Pub10], [Pub11], [Pub12], [Pub13], [Pub18], [Pub40].

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[Edu13], [Edu66], [Edu106]; [Pro22]; [MSc35]; [BSc33]; [Pub100].

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[Edu45], [Edu47], [Edu117]; [Pro12], [Pro13], [Pro16], [Pro30]; [PhD1]; [Pub43], [Pub67], [Pub80], [Pub147]; [Pat5].

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[Edu12], [Edu53]; [Pro4], [Pro11], [Pro17], [Pro22], [Pro40], [Pro43]; [BSc75]; [Pub31], [Pub44], [Pub107].

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[Edu23], [Edu39], [Edu42], [Edu117]; [Pro23]; [BSc59], [BSc66], [BSc74].

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[Edu31], [Edu54], [Edu105], [Edu116]; [Pro31].

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[Edu2], [Edu5], [Edu115]; [Pro26]; [MSc41]; [BSc13], [BSc53], [BSc80], [BSc84], [BSc85], [BSc86].

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[Edu18] [Edu58], [Edu89]; [Pro9], [Pro24], [Pro44]; MSc17], [MSc45]; [BSc37]; [Pub39], [Pub45], [Pub52], [Pub63], [Pub76], [Pub89], [Pub90].

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[Edu3], [Edu9], [Edu116]; [Pro5], [Pro6], [Pro8], [Pro31]; [Pub40], [Pub41].

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[Edu72]; [Pro4], [Pro14], [Pro15], [Pro22], [Pro46]; [MSc26]; [Pub16], [Pub19], [Pub21], [Pub25], [Pub28], [Pub73], [Pub74], [Pub86], [Pub87], [Pub88], [Pub95], [Pub96], [Pub97], [Pub120], [Pub121], [Pub122], [Pub131], [Pub132], [Pub133], [Pub134], [Pub135], [Pub137].

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[Edu64]; [Pro11], [Pro17], [Pro22], [Pro40], [Pro43]; [BSc15], [BSc25]; [Pub98], [Pub118].

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[Edu74], [Edu82], [Edu117]; [Pro25]; [BSc72]; [Pub20], [Pub101].

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[Pub1].

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[Edu11], [Edu50], [Edu87]; [Pro25]; [BSc5], [BSc19]; [Pub46], [Pub101].

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[Edu55], [Edu117]; [Pro32], [Pro35]; [MSc24], [MSc27]; [BSc26]; [Pub65], [Pub110], [Pub119].

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[Edu16], [Edu61]; [Pro32]; [BSc49]; [Pub54], [Pub55], [Pub56], [Pub110], [Pub124].

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[Edu17], [Edu44], [Edu70], [Edu71], [Edu84]; [Pro5], [Pro6], [Pro8], [Pro30]; [Pub7], [Pub8], [Pub9], [Pub10],[Pub11], [Pub40], [Pub41].

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[Edu19], [Edu24], [Edu73]; [Pro22]; [Pub112].

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[Edu27], [Edu36], [Edu37], [Edu107]; [Pro27]; [Pub29], [Pub111], [Pub140].

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[Edu22]; [Pro26]; [MSc14], [MSc19]; [Pub23], [Pub113].

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[Edu70], [Edu71], [Edu92]; [Edu117]; [Pro19], [Pro25]; [Pub49], [Pub76], [Pub92], [Pub108], [Pub114], [Pub116].

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[Edu25], [Edu28], [Edu36], [Edu37], [Edu116]; [Pro27]; [PhD4]; [Pub22], [Pub29], [Pub60], [Pub61], [Pub111], [Pub140], [Pub154].

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[Edu38],[Edu43], [Edu76]; [Pro23]; [MSc15], [MSc16]; [BSc44].

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[Pro36], [Pro37], [Pro42]; [BSc64], [BSc67]; [Pub104].

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[Pro23]; [Pub150].

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[Edu31], [Edu116]; [Pro7], [Pro31], [Pro38], [Pro39], [Pro44]; [MSc43]; [Pub41], [Pub57].

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[Pro6], [Pro8]; [BSc46], [BSc63].

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[Edu116]; [Pro31]; [Pub127], [Pub128], [Pub147].

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[Edu67], [Edu90]; [Pro22].

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[Pro1], [Pro5], [Pro6], [Pro8], [Pro31], [Pro45]; [BSc38]; [Pub3], [Pub4], [Pub5], [Pub6], [Pub7], [Pub8], [Pub9], [Pub10],[Pub11], [Pub12], [Pub13], [Pub18], [Pub40], [Pub41].

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[Edu26], [Edu41]; [Pro14], [Pro15], [Pro18], [Pro21], [Pro48]; [MSc31]; [BSc3]; [Pub18], [Pub19], [Pub21], [Pub25], [Pub28], [Pub71], [Pub72], [Pub73], [Pub74], [Pub86], [Pub87], [Pub88], [Pub95], [Pub96], [Pub97], [Pub120], [Pub121], [Pub122], [Pub130], [Pub131], [Pub132], [Pub133], [Pub134], [Pub135], [137].

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[Edu59], [Edu80], [Edu117]; [Pro23]; [PhD2]; [MSc4], [MSc6], [MSc33]; [Pub38], [Pub62], [Pub70], [Pub79], [Pub125], [Pub126], [Pub149].

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[Edu62], [Edu77], [Edu116]; [Pro31], [Pro36], [Pro37], [Pro42]; [PhD3]; [BSc27], [BSc30], [BSc39]; [Pub40], [Pub103], [Pub104], [Pub105], [Pub141].

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[Edu51], [Edu52], [Edu116]; [Pro28]; [MSc1]; [BSc56]; [Pub15].

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M.Sc. ('83), Ph.D. ('96); microwave technique; **Senior Lecturer**, Microwave and Radiolocation Engineering Division.
Golden Medal for Long-lasting Service ('18).
[Pro22]; [BSc11]; [Pub139].

Wiesław Winiecki
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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 Multimedia 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-); 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 an individual award of the Rector ('18).
[Edu1], [Edu21], [Edu30], [Edu94]; [Pro29]; [MSc25]; [BSc2]; [Pub16], [Pub32], [Pub33], [Pub78], [Pub143], [Pub144], [Pub145], [Pub146]; [Pat2], [Pat3], [Pat6], [Pat7].

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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-).
[Edu21], [Edu32], [Edu67], [Edu117]; [Pro4], [Pro11], [Pro17], [Pro22], [Pro40], [Pro43]; [Pub31], [Pub85], [Pub107], [Pub108].

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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-); Medal of the National Education Committee ('18).
[Edu4], [Edu60], [Edu118]; [Pro2], [Pro3], [Pro12], [Pro13], [Pro16], [Pro30]; [PhD1]; [MSc10]; [BSc12], [BSc48]; [Pub27], [Pub42], [Pub43], [Pub67], [Pub80], [Pub148], [Pub155]; [Pat1], [Pat4].

Krzyszof 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 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-);
[Edu49], [Edu70], [Edu71]; [Pro1], [Pro5], [Pro6], [Pro8], [Pro31]; [BSc55]; [Pub3], [Pub4], [Pub5], [Pub6], [Pub7], [Pub8], [Pub9], [Pub10], [Pub11], [Pub12], [Pub13], [Pub18], [Pub40], [Pub41].

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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 Technical Committees of the Polish Committee for Standardization ('09-); Medal of the National Education Committee ('18).
[Edu34], [Edu70], [Edu71], [Edu75], [Edu117]; [Pro32]; [MSc11]; [BSc14], [BSc71]; [Pub24], [Pub85], [Pub124], [Pub151], [Pub152].

2.2. Junior academic staff

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

Ph.D. Student (tutor)

Ph.D. Student	(tutor)
Jonatan Borkowski, M.Sc.	*(P. Bilski)*
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)*
Grzegorz Gwardys, M.Sc.	*(W. Skarbek)*
Maciej Jasiński, M.Sc.	*(J. Żera)*
Tomasz Karpisz, M.Sc.	*(B. Salski)*
Marcin Kołakowski, M.Sc.	*(J. Modelski)*
Bartosz Kossowski, M.Sc.*	*(P. Bogorodzki)*
Dawid Kuchta, M.Sc.	*(W. Wojtasiak)*
Jacek Majer, M.Sc.*	*(J. Żera)*
Tomasz Markowski, M. Sc.*	*(P. Bilski)*
Tomasz A. Miś, M.Sc.	*(J. Modelski)*
Zbigniew Nasarzewski, M.Sc.*	*(W. Skarbek)*
Denys Nyzovets, M.Sc.*	*(Y. Yashchyshyn)*
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)*
Maciej Soszka, 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)*
Katarzyna Wynimko, M.Sc.	*(J. Żera)*

Chang Xin, M.Sc.   *(W. Skarbek)*
Bartosz Żłobiński, M.Sc.   *(J. Żera)*

* without scholarship

2.4. Technical and administrative staff

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Izabela Dudek, Secretary
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 e-mail: I.Dudek @ire.pw.edu.pl

Monika Feluś, M.A., Secretary
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Aleksandra Jefimowicz, M.A., Financial Spec.
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Janina Nowak, Accountant
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Anna Smenda, Secretary
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 fax: +48 22 8253769
 e-mail: A.Smenda@ire.pw.edu.pl

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Joanna Witkowska, Adm. Specialist (till Oct. 2018)
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temporary research staff for the projects: *TEAM--TECH, **WidePOWER

3. TEACHING ACTIVITIES

(the summer semester of the academic year 2017/2018 and the winter semester of the academic year 2018/2019)

3.1. Regular studies – main fields of study:

**1. Telecommunications
Specialization: Radiocommunications and Multimedia Technology**

Head

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

**2. Electronics
Specialization: Electronics and Information Technology in Medicine**

Head

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

3.1.1. Basic courses

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

[Edu2] *Analog and Digital Radio Broadcasting Systems* (Systemy radiofonii analogowej i cyfrowej - RAC); 45 h/sem.; W. Kazubski.

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

[Edu8] *Basics of Medical Imaging Techniques* (Podstawy technik obrazowania w medycynie – PTOM); 60 h/sem.; P. Brzeski.

[Edu9] *Basics of Microprocessor Technique* (Podstawy techniki mikroprocesorowej – TMIK); 60 h/sem.; K. Derzakowski B. Konarzewski.

[Edu10] *Basics of Programming* (Podstawy programowania – PPR); 60 h/sem.; A. Podgórski.

[Edu11] *Basics of Radiocommunications* (Podstawy radiokomunikacji – PR); 45 h/sem.; J. Cichocki, K. Kurek.

[Edu12] *Basics of Radiolocation and Radionavigation* (Podstawy radiolokacji i radionawigacji – PRIR); 45 h/sem; D. Gryglewski

[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.;T. Rubel.

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

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

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

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

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

[Edu21] *Diploma Seminar for Undergraduate Students* (Seminarium dyplomowe inżynierskie – SDI); 30 h/sem.; P. Brzeski, W. Winiecki, W. Wojtasiak.

[Edu22] *Dc/dc Power Converters Supply* (Zasilanie układów elektronicznych - ZUE); 45 h/sem.; M. Mikołajewski.

[Edu23] *Event-Driven Programming* (Programowanie zdarzeniowe – PROZE); 45 h/sem.; K. Ignasiak.

[Edu24] *Evolutionary Algorithms* (Algorytmy ewolucyjne – AE); 45 h/sem.; P. Miazga.

[Edu25] *Ethical Aspects of Research and Engineering* – EEARE; 30 h/sem; R. Z. Morawski, P. Mazurek (English-medium studies).

[Edu26] *Fields and Waves* (Pola i fale – POFA); 60 h/sem.; B. Salski.

[Edu27] *Influence of Electromagnetic Waves on Living Organisms* (Oddziaływanie fal elektromagnetycznych na organizmy żywe – OFE); 30 h/sem.; K. Derzakowski.

[Edu28] *Introduction to Numerical Methods* (Wstęp do metod numerycznych – WNUM); 45 h/sem.; R. Z. Morawski, A. Miękina, A. Podgórski, P. Mazurek.

[Edu29] *Introduction to Medical Science* (Wprowadzenie do nauk medycznych – WNM); 45 h/sem.; K. Szopiński.

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

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

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

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

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

[Edu35] *Nuclear Medicine Techniques* (Techniki medycyny nuklearnej – TMENU); 30 h/ sem.; R. Szabatin.

[Edu36] *Numerical Methods* (Metody numeryczne – MNUB); 45 h/sem.; R. Z. Morawski, A. Miękina, A. Podgórski, P. Mazurek.

[Edu37] *Numerical Methods* – ENUME; 60 h/sem.; R. Z. Morawski, A. Miękina, A. Podgórski (English-medium studies).

[Edu38] *Object-oriented Programming M* (Programowanie obiektowe M – PROE); 60 h/sem.; J. Naruniec.

[Edu39] *Object-oriented Programming of Multimedia Applications in Java (*Java – obiektowe programowanie aplikacji multimedialnych – OPA); 45 h/sem.; K. Ignasiak.

[Edu40] *Orientation* (Orientacja – ORM); 15 h/sem.; J. Cichocki.

[Edu41] *Physics 2* – EPHY2; 60 h/sem.; B. Salski (English-medium studies).

[Edu42] *Programming of Geoinformation Applications* (Programowanie aplikacji geoinformacyjnych – PAG); 30 /sem.; K. Ignasiak (for Faculty of Geodesy and Cartography).

[Edu43] *Programming Languages (*Języki programowania - JP); 60 h/sem.; J. Naruniec.

[Edu44] *Radiation Detection* (Detekcja promieniowania jonizującego – DEPJO); 30 h/sem.; J. Marzec.

[Edu45] *Radiocommunication Systems* (Systemy radiokomunikacyjne – SRKO); 45 h/sem.; K. Godziszewski.

[Edu46] *Radioelectronics Measurements (*Miernictwo radioelektroniczne – MR); 45 h/sem.; J. Cichocki.

[Edu47] *Radio Networks and Systems* (Systemy i sieci radiowe – SISR); 45 h/sem.; K. Godziszewski.

[Edu48] *Radiological Apparatus in Medical Diagnostics* (Aparatura radiologiczna w diagnostyce medycznej – ARDM); 30 h/sem.; G. Domański.

[Edu49] *Radiology and Nucleonics* (Radiologia z nukleoniką – RN); 45 h/sem.; K. Zaremba.

[Edu50] *Satellite Communications* (Łączność satelitarna – LS); 45 h/sem.; K. Kurek.

[Edu51] *Signals and Systems* (Sygnały i systemy – SYGSY); 60 h/sem.; K. Snopek.

[Edu52] *Signals, Modulations and Systems (*Sygnały, modulacje i systemy – SYMSE); 45 h/sem.; K. Snopek.

[Edu53] *Simulations of Radioelectronics Circuits* (Symulacja układów radioelektronicznych – SUREL); 45 h/sem.; D. Gryglewski.

[Edu54] *Software for Medical Systems (*Oprogramowanie systemów medycznych – OSM); 45 h/sem.; R. Kurjata, T. Jamrógiewicz.

[Edu55] *Sound Recording Technique* (Dźwiękowa technika studyjna – DTS); 45 h/sem.; M. Lewandowski.

[Edu56] *Television Systems* (Systemy telewizyjne – SYTE); 45 h/sem.; A. Buchowicz, M. Rusin.

[Edu57] *Ultrasonography Instrumentation* (Aparatura ultrasonograficzna – AUS); 30 h/sem.; R. Jóźwiak.

[Edu58] *UMTS and LTE Systems (Systemy UMTS i LTE* – ULTE*)*; 45 h/sem.; J. Kołakowski.

3.1.2. Advanced courses

[Edu59] *Adaptive Image Recognition* – EADIR; 60 h/sem.; W. Skarbek.

[Edu60] *Antennae Theory and Design* (Teoria i projektowanie anten – TPA); 60 h/sem.; Y. Yashchyshyn.

[Edu61] *Audio Equipment Investigation* (Badania urządzeń audio – BUA); 45 h/sem.; G. Makarewicz.

[Edu62] *Computed Tomography* (Tomografia komputerowa – TOM); 60 h/sem.; W. Smolik.

[Edu63] *Computer - Aided Medical Image Diagnostics* (Komputerowe wspomaganie obrazowej diagnostyki medycznej – KWOD); 45 h/sem.; A. Przelaskowski.

[Edu64] *Computional Electromagnetics for Telecommunications* – ECOET; 60 h/sem.; P. Korpas (English-medium studies).

[Edu65] *Contemporary Heuristic Techniques* (Współczesne techniki heurystyczne – WMH); 60 h/sem.; P. Bilski.

[Edu66] *Data Compression* (Kompresja danych – KODA); 45 h/sem.; G. Galiński, G. Pastuszak.

[Edu67] *Design of Microwave Circuits* (Projektowanie układów mikrofalowych – PUM); 60h/sem.; W. Wojtasiak, S. Rosłoniec.

[Edu68] *Design of Radiocommunication Systems* (Projektowanie układów radiokomunikacyjnych – PSRD); 60 h/sem.; T. Kosiło.

[Edu69] *Digital Audio Signal Processing* (Cyfrowe przetwarzanie sygnałów fonicznych – CPSF); 45 h/sem.; Z. Kulka

[Edu70] *Diploma Seminar for Graduate Students 1* (Seminarium dyplomowe magisterskie 1 – SDM1); 30 h/sem.; J. Marzec, J. Modelski, K. Zaremba, J. Żera.

[Edu71] *Diploma Seminar for Graduate Students 2* (Seminarium dyplomowe magisterskie 2 – SDM2); 30 h/sem.; J. Marzec, J. Modelski, K. Zaremba, J. Żera.

[Edu72] *Electromagnetic Compatibility* (Kompatybilność elektromagnetyczna – KE); 30 h/sem.; P. Kopyt.

[Edu73] *Evolutionary Algorithms* – EEVAL; 60 h/sem.; P. Miazga (English-medium studies).

[Edu74] *Graphs and Networks* (Grafy i sieci – GIS); 60 h/sem.; S. Kozłowski.

[Edu75] *Hearing and Sound Perception* (Słyszenie i percepcja dźwięku – SPD); 45 h/sem.; J. Żera.

[Edu76] *Image and Audio Semantic Analysis* (Analiza semantyczna dźwięku i obrazu – ASOD); 45 h/sem.; J. Naruniec.

[Edu77] *Informatics Systems in Medicine* (Systemy informatyczne w medycynie – SIM); 45 h/sem.; W. Smolik.

[Edu78] *Large-scale Measurement Methods in Molecular Biology* (Wielkoskalowe metody pomiarowe w biologii molekularnej – MPB); 45 h/sem; T. Rubel.

[Edu79] *Magnetic Resonance Imaging* (Tomografia rezonansu magnetycznego – TRM); 45 h/sem.; P. Bogorodzki.

[Edu80] *Mathematics in Multimedia* (Matematyka w multimediach – MATMU); 60 h/sem.; W. Skarbek.

[Edu81] *Methodological and Ethical Aspects of Research* – EMAR); 45 h/sem.; R. Z. Morawski.

[Edu82] *Modern Radio Transmission Techniques* (Nowe techniki transmisji radiowej – NTTR); 45 h/sem.; S. Kozłowski.

[Edu83] *Neural Networks in Biomedical Applications* (Sieci neuronowe w zastosowaniach biomedycznych – SNB); 45 h/sem., K. Zaremba.

[Edu84] *Noise and Electromagnetic Interference in Electronic Devices* (Szumy i zakłócenia w aparaturze elektronicznej – SZAE); 45 h/sem., J. Marzec.

[Edu85] *Nuclear Medicine Techniques* (Techniki medycyny nuklearnej – TMN); 60 h/sem.; R. Szabatin.

[Edu86] *Radio Localization and Identification Systems* (Radiowe systemy lokalizacji i identyfikacji – RADS); 45 h/sem.; P. Bajurko.

[Edu87] *Satellite Telecommunications* (Telekomunikacja Satelitarna – TSAT); 30 h/sem.; K. Kurek (for Faculty of Power and Aeronautical Engineering).

[Edu88] *Telemedical Systems* (Systemy telemedyczne - TELM); 45 h/sem., R. Kurjata.

[Edu89] *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

[Edu90] *Antennae* (Anteny – ANM); 30 h/sem.; semester 4; S. Rosłoniec.

[Edu91] *Basics of Logical Circuits and Microprocessor Technique* (Układy logiczne i podstawy techniki mikroprocesorowej – PULM); 60 h/sem.; semester 4; B. Konarzewski.

[Edu92] *Basics of Satellite Communications* (Podstawy łączności satelitarnej – SATM); 30 h/sem.; semester 4; J. Modelski.

[Edu93] *Broadcasting Systems* (Systemy radiodyfuzyjne – SRDM); 60 h/sem.; semester 6; A. Buchowicz, H. Chaciński.

[Edu94] *Computer Control and Data Processing* (Komputerowe sterowanie i przetwarzanie danych – KSTM); 45 h/sem.; semester 4, W. Winiecki.

[Edu95] *Digital Cellular Systems* (Cyfrowe systemy komórkowe – CSKM); 36 h/sem.; semester 7; J. Cichocki.

[Edu96] *Digital Signals Transmission* (Cyfrowa transmisja sygnałów – CTSM); 45 h/sem.; semester 5; T. Kosiło.

[Edu97] *Diploma Seminar 1* (Seminarium dyplomowe – SDM); 15 h/sem.; semester 7; J. Cichocki.

[Edu98] *Diploma Seminar 2* Seminarium dyplomowe – SD2M); 30 h/sem.; semester 8; J. Cichocki.

[Edu99] *Elements of Material Culture* (Elementy kultury materialnej – EKM); semester 6; 15 h/sem.; W. Brzeziński.

[Edu100] *Ergonomics and Safety* (Ergonomia i bezpieczeństwo pracy – EBPZ); 30 h/sem.; semester 8; L. Kryst.

[Edu101] *Information and Knowledge Society* (Społeczeństwo informacji i wiedzy - SWM) 15 h/sem.; semester 8; P. Stacewicz

[Edu102] *Internet Techniques* (Techniki Internetowe – TINM), 30 h/sem.; semester 7; K. Ignasiak.

[Edu103] *Management and Marketing* (Zarządzanie i marketing – ZMM), 15 h/sem.; semester 7, T. Tyc.

[Edu104] *Multimedia Applications* (Aplikacje multimedialne – AMRM); 30 h/sem.; semester 5; T. Rubel.

[Edu105] *Multimedia Computer Systems* (Multimedialne systemy komputerowe – MSKM); 30 h/sem.; semester 4; T. Jamrógiewicz.

[Edu106] *Multimedia Techniques* (Techniki Multimedialne – TMM); 30h/sem.; semester 6; G. Galiński.

[Edu107] *Numerical and Statistical Techniques* (Techniki obliczeniowe i symulacyjne – TOSM); 30 h/sem.; semester 4; A. Miękina.

[Edu108] *Programmable Digital Devices* (Programowalne układy cyfrowe – PUCM); 45 h/sem.; semester 5; M. Ziembicki.

[Edu109] *Radiocommunication Systems 1* (Systemy radiokomunikacyjne 1 – SRKM); 60 h/sem.; semester 6; T. Kosiło.

[Edu110] *Radiocommunication Systems 2* (Systemy radiokomunikacyjne 2 – SRK2M); 60 h/sem.; semester 7; T. Kosiło.

[Edu111] *Radioelectronics Measurements* (Miernictwo radioelektroniczne – MRM); 45 h/sem.; semester 5; J. Cichocki.

[Edu112] *Rules of Industrial Property* (Prawa własności przemysłowej – PWPR); 15 h/sem.; semester 7; C. Woźniak.

[Edu113] *Signal Processors* (Procesory sygnałowe – SKMM); 30 h/sem.; semester 6, A. Podgórski.

[Edu114] *Sound Techniques* (Techniki dźwiękowe – TDRM); 30 h/sem.; semester 7; P. Bobiński.

[Edu115] *Technique of Emission and Receiving* (Technika emisji i odbioru – TEM); 45 h/sem.; semester 5; W. Kazubski.

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:

- Budapesti Műszaki és Gazdaságtudományi Egyetem, Budapest, Hungary (2 persons);
- École des Mines de Paris, Paris, France (1 person);
- École Nationale Supérieure d'Arts et Métiers, Paris, France (1 person)
- École Nationale Supérieure des Télécommunications de Paris, Paris, France (2 persons)
- École Supérieure de Physique et de Chimie Industrielle, Paris, France (3 persons);
- École Supérieure de techniques Avancées, Paris, France (3 persons) ;
- Institut d'Optique Graduate School, Paris, France (1 person);
- Instituto Superior Técnico, Lisbon, Portugal (6 persons);
- Katholieke Universiteit Leuven, Leuven, Belgium (8 persons);
- Politecnico di Milano, Milano, Italy (2 persons) ;
- Technische Universiteit Delft, Delft, The Netherlands (4 person);
- Technische Universität München, Munich, Germany (1 person);
- Telecom ParisTech, Paris, France (7 persons);
- Universidad Politécnica de Madrid, Madrid, Spain (3 persons).

3.4. Educational projects

[Edu116] **Modification B.Sc. Studies: Biomedical Enginnering in the frame of Knowledge – Education – Development - Cooperation Project** (Modyfikacja studiów pierwszego stopnia na kierunku „Inżynieria Biomedyczna" w ramach projektu NERW – Nauka – Edukacja - Rozwój - Współpraca). **Waldemar Smolik**, R. Z. Morawski, P. Bogorodzki, K. Snopek, P. Brzeski, G. Domański, T. Jamrógiewicz, B. Konarzewski, R. Kurjata, E. Piątkowska-Janko, D. Radomski, T. Rubel, J. Kryszyn, W. Obrębski; Feb. 01, 2018 – Jan. 01, 2021
Funded by the National Centre for Research and Development EU Operational Programme Knowledge – Education – Development - Cooperation 2014-2020

The main goal of this project is to modificate Biomedical Engineering B.Sc. studies, by means of introduction two specializations: Electromedical Equipment and Systems, and Biomedical Informatics. Research team taking part in this project includes scientists from the Faculty of Electronics and Information Technology and the Faculty of Mechatronics, WUT.

[Edu117] **Modification B.Sc. Studies: Telecommunications in the frame of Knowledge – Education – Development - Cooperation Project** (Modyfikacja studiów pierwszego stopnia na kierunku „Telekomunikacja" w ramach projektu NERW – Nauka – Edukacja - Rozwój - Współpraca) **Jacek Cichocki**, P. Bobiński, A. Buchowicz, K. Godziszewski, K. Ignasiak, P. Korpas, S. Kozłowski, M. Lewandowski, R. Łukaszewski, J. Modelski, D. Rosołowski, W. Skarbek, W. Wojtasiak, J. Żera. Feb. 01, 2018 – Jan. 01, 2021
EU Operational Programme Knowledge – Education – Development - Cooperation 2014-2020
Funded by the National Centre for Research and Development

The project is realized in the frame of EU The main goal of this project is to modify Telecommunications B.Sc. academic programme by means of introduction two new specializations: Teleinformatics and Wireless and Multimedia Technologies using new teaching methods.

3.5. Summer schools

[Edu118] **Y. Yashchyshyn**: "Advanced Antenas Reconfiguration" a lecture delivered during *3rd ITN CELTA Summer School 2018 and 28th International Travelling Summer School (ITSS) on Microwaves and Lightwaves* (Prague, Czech Republic, Jul. 7-13, 2018).

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 Inno-
vation Staff Exchange, as a part of collaboration be-
tween 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 Re-
search 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, hard-
ware and software development for the new genera-
tion detectors.

[Pro2] **CELTA – Convergence of Electronics
and Photonics Technologies for Ena-
bling Terahertz Applications** (Konwer-
gencja 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 Train-
ing Networks.
CELTA is the acronym for Convergence of Electronics
and Photonics Technologies for Enabling Terahertz
Applications. CELTA aims to produce the next gener-
ation of researchers who will enable Europe to take a
leading role in the multidisciplinary area of utilising
Terahertz technology for applications involving com-
ponents and complete systems for sensing, instru-
mentation, imaging, spectroscopy, and communica-
tions. All these technologies are keys to tackling chal-
lenges and creating solutions in a large number of
focus areas relevant for the societal challenges identi-
fied 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 multidiscipli-
nary scientific expertise, complementary skills, and
experience working in academia and industry to em-
power ESRs to work in interdisciplinary teams, inte-
grate their activities, share expertise, and promote a
vision of a converged co-design and common engi-
neering 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 spe-
cial effort on establishing a common engineering
language in its training programme across the elec-
tronics, photonics and applications disciplines. We
believe this common engineering language and con-
verged co-design is mandatory to make the next logi-
cal 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 pro-
gramme 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 materi-
als characterisation, and a THz imager for sensing
applications.

[Pro3] **IMAGE – Innovative Optical/Quasioptical
Technologies and Nano-Engineering of
Anisotropic Materials for Creating Ac-
tive Cells with Substantially Improved
Energy Efficiency** (Innowacyjne op-
tyczne/quasi optyczne techniki oraz
inżynieria nanomateriałów i materiałów ani-
zotropowych dla opracowania struktur
czynnych z zasadniczo poprawioną efek-
tywnością energetyczną).
Yevhen Yashchyshyn, P. Bajurko, J. So-
bolewski
Feb. 01, 2018 – Jan. 31, 2022
Horizon 2020, EU Framework Programme
for Innovative Training Networks.

The principal goal of the project is to combine re-
search expertise in optics, crystallography and mate-
rial science with efforts in material engineering to go
beyond state-of-the-art in the development of highly
efficient energy saving optical cells based on electro-,
acousto- and nonlinear optical effects and designed to
operate in optical and quasi-optical (sub-THz) ranges.
The idea of the project arises from recent advances in
nano engineering combined with our technology.

[Pro4] **Precision Technique of Millimeter and
sub-THz Band Characterization of Mate-
rials for Microelectronics** (Dokładne
metody charakteryzacji materiałów dla
mikroelektroniki w paśmie fal milime-
trowych i subterahercowych).
Jerzy Krupka (IMiO) **Paweł Kopyt**
(IRiTM): heads of the research teams;
D. Gryglewski, M. Piasecki, W. Wojtasiak;
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 struc-
tures 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 measure-
ment techniques based on multimode resonant struc-

tures. 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

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

[Pro6] **The T2K Neutrino Second Generation Experiment** (T2K – eksperyment neutrinowy drugiej generacji).
Krzysztof Zaremba, J. Marzec, M. Dziewiecki, G. Domański, B. Konarzewski, R. Kurjata, M. Ziembicki, A. Rychter, P. Płoński;
HARMONIA, International project realized in collaboration with the Faculty of Physics, Warsaw University, the Andrzej Soltan Institute for Nuclear Studies, the Henryk Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences, Faculty of Physics and Astronomy, Wroclaw University, Silesian University;
Oct. 10, 2012 – Sept. 22, 2022
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.

[Pro7] **Self-Navigated Integrin Receptors Seeking "Thermally-Smart" Multifunctional Few-Layer Graphene-Encapsulated Magnetic Nanoparticles for Molecular MRI-Guided Anticancer Treatments in "Real Time" Personalized Nanomedicine** (Samonaprowadzające na receptory integrynowe "termicznie-reaktywne" 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, M. Wieteska;
Aug. 03, 2015 – Nov. 01, 2019
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 released 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 genetic/epigenetic approaches to characterize the GEMNS theranostic contrast/drug candidates compliant with regulatory requirements.

[Pro8] **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 – Jan. 27, 2019
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, antipro-

tons). 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.

[Pro9] **IONIS (Indoor and Outdoor NITICSplus Solution for Dementia Challenges)** (System wsparcia osób z zaburzeniami funkcji poznawczych w środowisku domowym i poza domem).
Jerzy Kołakowski, 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 addresses the needs people with cognitive impairment and their caregivers. Its main objective is a development of a fully integrated and validated platform for health monitoring, home automation, personal agenda with reminders, alerts, caregiver administrative tools. IONIS intends to exploit NITICS innovation and extend the platform with new technologies and services for both indoor and outdoor support. Localization of items, analysis of persons mobility or geofencing are examples of services dedicated to people with cognitive impairment.

[Pro10] **INCARE (Integrated Solution for Innovative Elderly Care)** (Zintegrowany system innowacyjnych rozwiązań dla opieki nad osobami starszymi)
Jerzy Kołakowski, V. Djaja-Jośko
J. Cichocki, M. Kołakowski;
Oct. 01, 2018 – Sept. 30, 2021
IONIS, AAL Joint Programme
Funded by the National Centre for Research and Development

INCARE is designed to support seniors to live independently and reduce or optimize the amount of care they require. The goal of the project is to develop the INCARE platform that will be modular, highly configurable and adaptable such as to be easily adopted and used by elderly with various backgrounds, cultures and age related impairments. The platform will integrate technologies and services for both indoor and outdoor support developed within NITICS project with autonomous, intelligent and adaptable RAPP robotic platform.

4.2.3. Research grants

[Pro11] **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.

[Pro12] **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 – Dec. 31. 2018
Funded by the National Centre for Research and Development

The aim of the project is to develop design methods for implementation and integration of millimeter-wave systems realized in the LTCC (Low Temperature Co-fired Ceramic) technology. Several building blocks of wireless millimeter-wave systems operating in the frequency band between 20 and 140 GHz will be developed: novel antennas and antenna-arrays, transmission lines, passive elements (e.g. couplers, filters). A variety of interconnect techniques (e.g. wire-bonding) between the chip and the planar transmission lines will be analyzed, including matching structures. The goal of the project is to achieve a level of technical maturity of impelemention 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.

[Pro13] **Sub-THz Active 3D Scanner for Counterterrorism Purposes** (Aktywny sub-THz skaner 3D do zastosowań antyterrorystycznych).
Yevhen Yashchyshyn, P. Bajurko, S. Kozłowski, G. Bogdan, K. Godziszewski;
Sept. 01, 2015 – Feb. 28. 2019
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.

[Pro14] **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, 2019
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.

[Pro15] **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.

[Pro16] **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.

[Pro17] **Semiconductor Technology for High Power Electronics and High Frequencies** (Technologie materiałów półprzewodnikowych dla elektroniki dużych mocy i wysokich częstotliwości).
Daniel Gryglewski, W. Wojtasiak, D. Rosołowski, P. Korpas, D. Kuchta, M. Góralczyk, D. Kołodziej, M. Lubiejewski;
Jan. 03, 2018 – Nov. 30, 2020
Strategic research and development program "Modern material technologies" – **WidePOWER**, in the frame of program **TECHMATSTRATEG** (Nowoczesne technologie materiałowe)
Funded by the National Centre for Research and Development

The main goal of the project is to develop silicon carbide homoepitaxy (SiC) and gallium nitride heteroepitaxy (GaN) technologies towards epitaxial production-quality structures for the production of dedicated semiconductor devices.
The Institute of Radioelectronics and Multimedia Technology, WUT is responsible for the implementation of demonstrators of power converters based on GaN-on-Si transistors. For this purpose, developed design procedures and made RF impulse generators on GaN / Si HEMT transistors for aerospace applications will be developed.

4.2.4. Grants for young researchers

[Pro18] **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;
Sept. 22, 2017 – Jul. 22, 2020
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.

[Pro19] **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).
Józef Modelski (supervisor): T. A. Miś;
Mar. 23, 2017 – Sept. 30, 2018
'Best of the Best 2.0' 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.

[Pro20] **Fusion of Measurement Data from Impulse-Radar Sensors and Depth Sensors when Applied for Monitoring of Elderly and Disabled Persons** (Integracja danych z impulsowych czujników radarowych i czujników głębi w systemie monitoringu osób starszych i niepełnosprawnych).
Paweł Mazurek;
Feb 26, 2018 – Feb. 25, 2020
PRELUDIUM Programme
Funded by the National Science Centre

The project is oriented on testing the hypothesis that the ultra-low-power impulse-radar sensors and infrared depth sensors can be applied for non-invasive and non-intrusive monitoring of the movements of elderly and disabled persons in their home environment, and that fusion of measurement data acquired by means of these sensors can decrease the uncertainty of the estimation of position and other health-related quantities – thus, increase the reliability of the monitoring. The aim of the research is, therefore, to develop an effective algorithmic basis for fusion of measurement data acquired by means of impulse-radar sensors and infrared depth sensors, to assess the performance of the developed algorithms when applied for estimation of the position of a monitored person, and of other health-related quantities, and to formulate the recommendations of practical nature concerning, *e.g.*, the placement of sensors and suitability of procedures of data fusion, taking into account the variety of health-related quantities to be monitored.

[Pro21] **Preparations of Proceedings and Abstracts on Material Characterization and Milimeter Technique for Foreign Conferences** (Przygotowanie publikacji i komunikatów konferencyjnych dotyczących charakteryzacji materiałów oraz techniki milimetrowej na konferencje zagraniczne).
Bartłomiej Salski (supervisor): J. Cuper M. Rytel, P. Czekała;
Jul. 07, 2018 – May 31, 2019
'Best of the Best 3.0' Program
Funded by the Ministry of Science and Higher Education in scope of EU Knowledge, Education, and Development Program

The project selected the largest and most significant conferences in the field of microwave techniques and characterization of microwave materials:
International Microwave Symposium 2018 conference (IMS), held every year in the United States. It is considered in the scientific community to be the largest and most important in the world. International Conference on Infrared, Millimeter and Terahertz Waves 2018 (IRMMW-THz) is devoted to millimeter, subtermere and far infrared wave technology. Another equally important event is the conference The 10th International Conference on Microwave Materials and Their Applications (MMA 2018) dedicated to materials used in microwave techniques. The last of the planned events is IEEE Radio and Wireless Symposium 2019 (RWS), a conference held as part of Radio & Wireless Week (RWW) in January 2019 in Orlando, USA. This is the next conference on microwave techniques, just like IMS. Due to a more distant date, the team has the opportunity to prepare a publication and present it at this conference, gaining both experience in presenting their achievements on the international arena and gaining knowledge about the leading trends in this field.

4.3 Projects granted by the University

4.3.1 Statutory projects

[Pro22] **Microwave and Optoelectronic Devices Design Using Electromagnetic Modelling with Account of the Coupled Physical Effects** (Projektowanie urządzeń mikrofalowych oraz na pasma fal milimetrowych i subterahercowych wspomagane modelowaniem pól elektromagnetycznych, obwodowym i z zakresu cyfrowego przetwarzania sygnałów).
Wojciech Wojtasiak, S. Rosłoniec, B. Salski, D. Rosołowski, D. Gryglewski, P. Kopyt, P. Korpas, P. Miazga, M. Sypniewski, M. Krysicki, M. Góralczyk, D. Kuchta, T. Karpisz, M. Lubiejewski;
May. 31, 2017 – Oct. 31, 2018

Research has been conducted in various scientific fields, including measurements of ferromagnetic materials, and development of broadband and resonant systems for characterization of materials in microwave and mm-wave, and sub-THz bands. The team contin-

ued 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 ITE. The research on SDR implementation has still carried out. As a support for the SDR concept development the works on DPD algorithms used to linearization of high-power GaN HEMT amplifiers excited by complex signals such as LTE signals are also started.

[Pro23] **Intelligent, Scattering, Network Video Systems** (Inteligentne, rozproszone, sieciowe systemy wideo).
Krystian Ignasiak, W. Skarbek, G. Pastuszak A. Buchowicz, G. Galiński, J. Naruniec;
May 31, 2017 – Oct. 31, 2018

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. (1) The work included tuning deep learning algorithms performed for face alignment and pose estimation problems. (2) The redefinition of given MIMD architecture to SIMD architecture for software tool for processing tensor signals contemporary important application for Human Computer Interfacing (HCI). (3) As part of the work, the facial multi-expression recognition as an element of HCI was developed as well as personalization of human head 3D model by extraction of the distinctive personal features from each camera frame using Candide 3D model – the personalized model is crucial for improvements of other HCI application like face expression recognition. (4) A method for color correction based on selected color samples from both input and reference images together with user-specified color temperature constraint has been proposed and compared with other color correction methods for performance validation.

[Pro24] **Application of Laser Scanner for Investigation of UWB Positioning System Accuracy and Precision** (Wykorzystanie skanera laserowego do badań dokładności i precyzji określania położenia w ultraszerokopasmowym systemie lokalizacyjnym).
Jerzy Kołakowski, J. Cichocki, V. Djaja-Jośko, M. Kołakowski;
May 31, 2017 – Oct. 31, 2018

Ultra-wideband positioning systems allow to localize objects with sub-meter accuracy. Therefore to effectively verify their performance it is crucial to determine real locations of localized objects with even greater accuracy. The result of the research are a device and an algorithm, that allow to determine this locations automatically. The proposed device contains both localized UWB tag and a laser scanner, which performs scans of its surroundings. Resulting scans are processed with the developed algorithm. The algorithm perform Principal Component Analysis on the obtained plans and finds lines corresponding to walls present in sensors vicinity and calculates its distance to them. Performed experiments have shown that the proposed solution allows to localize objects with high accuracy and would be helpful in testing performance of various localization systems.

[Pro25] **Application of SDR Techniques in Satellite Communications** (Zastosowanie technik radia programowalnego SDR w realizacji łączności satelitarnych).
Józef Modelski, K. Kurek, S. Kozłowski;
May 31, 2017 – Oct. 31, 2018

The aim of the project was an implementation of the digital signal processing algorithms for software realization of the transmitter and the receiver for a broadband satellite communication system. The laboratory set-up of the transmitter and the receiver was created using SDR module (Ettus USRP X310) and personal computer, allowing to transmit and receive signals with QPSK, 8PSK and 16APSK modulations (compatible with DVB-S2 standard) for data rates up to 40 Mbps.

[Pro26] **Class DE Resonant Power Amplifiers for Industry Application – Improvement of Solutions, Analysis and Design Methods** (Rezonansowe wzmacniacze mocy klasy DE do zastosowań przemysłowych – doskonalenie rozwiązań, analiza i metody projektowania).
Mirosław Mikołajewski, H. Chaciński, W. Kazubski;
May 31, 2017 – Oct .31, 2018

In the project analyses of Class DE resonant power amplifier operation in a dc/dc LLC resonant converter and an induction heater have been made. Obtained equations and circuit analytical descriptions were used to design and built a 100W/Vo=12V resonant dc/dc converter as well as a 500W induction heater. Experimental results for the designed circuits were in a good agreement with theoretical predictions. The built resonant dc/dc converter operated with maximum efficiency 93% and in the wide output power range from 10W to 100W its efficiency exceeded 80%. Moreover, measured levels of RF conducted emissions of the converter equipped with a specially designed compact filter fulfilled CISPR32 class B requirements. In the induction heater built as a part of this project low power losses in transistor switches resulted in elimination of transistors' sinks reducing the circuit size. The temperature 740°C of heated ferromagnetic steel object close to the designated one was achieved. In the project a frequency based efficient output power control method in a 100W 13,56MHz Class E amplifier with a GaN transistor was also studied. An over-voltage protection circuit for the used GaN transistor was proposed, built and successfully tested increasing the amplifier reliability.

[Pro27] **Methodological Aspects of Measurement Data Processing** (Metodologiczne aspekty przetwarzania danych pomiarowych).
Roman Z. Morawski, A. Miękina, A. Podgórski;
May 31, 2017 – Oct. 31, 2018

The primary objective of this project has been a synthesis of methodological experience related to the use of measurement in the interdisciplinary research practice. Selected aspects of the resulting methodology have been illustrated with applications in the domain of preventive care and diagnostics of various health conditions. The results of the project have been presented in a monograph (*Technoscientific Research – Methodological and Ethical Aspects*), a Ph.D. thesis (*Bayesian solutions of problems related to non-*

invasive and non-intrusive monitoring of elderly persons), two journal articles and three conference papers.

[Pro28] Research on Multidimensional Signal Transformations and Novel Radio Data Transmission Systems (Badania w dziedzinie przekształceń sygnałów wielowymiarowych oraz nowych systemów radiowej transmisji danych).
Kajetana Snopek, Ł. Błaszczyk, T. Kosiło;
May 31, 2017 – Oct. 31, 2018

The research focused on two problems: the development of theory of analytic signals and NB IoT - the new standard (3GPP) of the narrowband transmission dedicated to the Internet of Things. The main results of the first part were: formulation of the generalized Wiener-Khintchine theorem for the Octonion Fourier Transformation and elaboration of the new algorithm of envelope detection. The second part included experimental tests of the NB IoT standard in Łódź and Warsaw and preliminary studies on ITS (Intelligent Transportation System) mobile network data transmission.

[Pro29] Advancement of the Methods for the Monitoring and Diagnostics of Electrical Appliances and Analog Systems (Rozwój metod do monitoringu i diagnostyki urządzeń elektrycznych i systemów analogowych).
Wiesław Winiecki, P. Bilski, R. Łukaszewski, K. Mroczek, A. Wójcik, K. Dowalla;
May 31, 2017 – Oct. 31, 2018

Multiple measurement methods, software solutions and analysis techniques were developed for the non-intrusive monitoring of electrical appliances based on the selected parameters and features acquired from the analysis of current and voltage signals in the steady and transient states of the devices' operation modes. Multiple approaches and contraptions for the identification of the electrical appliances, their states and sources of the harmonic distortion were proposed. Methods for the diagnostics of analog systems were developed. Measurement and measurement and control systems with the advanced architectures using the modern hardware and software were assembled. Research results have been presented in 2 papers published in journals from the JCR list, 11 reports presented in international (8) and national (3) conferences, 3 of which are available in the Web of Science database. Also, 2 patents have been granted and 2 more filed to the Patent Office.

[Pro30] Investigation of Time Modulated Antenna Arrays for Wireless Transmission Systems (Badania możliwości wykorzystania anten z modulacją czasową w systemach nadawczych).
Yevhen Yashchyshyn, P. Bajurko K. Derzakowski, K. Godziszewski, G. Bogdan, D. Nyzovets, P. Piasecki, J. Sobolewski;
May 31, 2017 – Oct. 31, 2018

The aim of this statutory project was to investigate capabilities the time modulated antenna array (TMAA) which is applied in a wireless transmission system. The antenna adapts autonomously and provides a real-time improvement of quality of wireless transmission in constantly changing conditions. The TMAA's beam was controlled by the evolutionary algorithm with the fitness function based on the signal-to-noise ratio (SNR) measured by the receiver. This approach provided a real-time improvement of the SNR without complex computation. Experimental trials proved that the adaptive TMAA is capable of following a moving terminal inside a 100 degree-wide sector, even in a presence of an unwanted signal in the adjacent channel. Different scenarios were evaluated showing performance gains over a non-adaptive system.

[Pro31] Modern Techniques in Nuclear and Medical Electronics (Nowoczesne 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, E. Piątkowska-Janko, D. Radomski, B. Sawionek, W. Smolik, M. Ziembicki, W. Gradkowski, B. Kossowski, A. Rychter, M. Stosio, D. Wanta, K. Werys, M. Wieteska, P. Wróblewski, P. Tor;
May 31, 2017 – Oct. 31, 2018

Magnetic Resonance Imaging in Earth field

MRI (Magnetic Resonance Imaging) and NMR spectroscopy (Nuclear Magnetic Resonance) require high spatial and temporal magnetic field stability. The fluctuations of this field from moving ferromagnetic masses or from the supply line currents in urban centers often require additional equipment to compensate for this drift. This study covers e compensation method and implementation in the MRI system of Terranova (Magritek) EFRMR (Earth Field NMR) for SE (Spin Echo) and GE (Gradient Echo) sequences. The results of compensation for data collected in a large urban center (city center of Warsaw) are presented. This solution can be used as a replacement for hardware compensators to improve the quality of the imaging data.

Simulation of a multipixel photodiode system with a preamplifier

A multi-pixel avalanche photodiode is a matrix of elemental avalanche photodiodes operating in the Geiger mode - each element of the matrix has its own connected quenched resistor. All photodiode + resistor structures are connected in parallel, resulting in a two-terminal system that acts as a light detector and amplifier. The purpose of the work was to simulate a multi-pixel photodiode array (MPPC) system with a preamplifier. Such structures can be used in medical imaging systems.

Preliminary assessment of 3D imaging using EVT4 electrical capacitance tomography system

In the framework of the statutory research, the work on the development of a data acquisition system for electrical capacitance tomography was continued. In the previous years, three prototypes of the EVT4 tomographic system were built. As part of the current task, a preliminary assessment of the quality of tomographic images obtained using 3D acquisition mode was made. A method for selection of parameters of three-dimensional tomographic sensor (size and position of electrodes) was developed. The algorithm for gain adjustment in the measurement channels was used to increase the signal-to-noise ratio in measurements with a use of three-dimensional probe.

[Pro32] New Methods for Testing Sound Processing Quality (Nowe metody badania

jakości i przetwarzania dźwięku).
Jan Żera, P. Bilski, G. Makarewicz, A. Pietrzak, M. Lewandowski, P. Bobiński;
May 31, 2017 – Oct. 31, 2018

The study comprised three research projects. The purpose of the first project was to assess and analyze the linear and nonlinear systems of audio processing such as PCM and SigmaDelta modulators. Suitable algorithms for time-frequency analysis were selected for the use in further analysis. The second project was dedicated to the development of a method based on the grey systems theory (GST), intended for noise control at workplace and active compensation of distortion and noise in audio systems. The third project was a study of noise exposure among musicians done with the use of two-channel noise dosimetry. The daily noise exposure levels were measured for 15 musicians playing a flute, a clarinet, a trumpet and a trombone with special focus on solo playing and playing in a large orchestra. Results showed the degree of exposure and asymmetry of exposure between left and right ear. The fourth project was devoted to the use of the Wald sequential statistical test in adaptive staircase methods used in psychoacoustics. The feasibility of an adaptive, up-down staircase procedure which uses a decision rule based on the Wald sequential statistical test was examined. The staircase procedures, combined with the Wald test for selecting signal level, were tested as to their ability to converge at various threshold levels, accuracy, and bias.

4.3.2. Projects granted by the Dean

[Pro33] **Investigation of Time Modulated Antenna Array Functionality in MIMO System** (Badania funkcjonalności szyku antenowego z modulacją czasową w systemie MIMO).
Grzegorz Bogdan;
Jul. 05, 2018 – Dec. 31, 2018

MIMO systems require multiple antennas and multiple radio frequency (RF) chains in order to obtain uncorrelated spatial channels. This leads to cumbersome designs which were expensive to fabricate and consume a lot of energy. The main goal of this project was to design a receiver for 2×2 MIMO with only one RF chain, which can significantly reduce cost of a MIMO system. Proposed single-RF MIMO receiver was based on a time modulated antenna array. Diverse channels were obtained by periodical ON/OFF switching. Beam-steering was used to further improve the performance of a MIMO system by focusing the main beam of the receiving antenna toward some desired direction in space.

[Pro34] **Numerical Simulations of the Electric Field for Dense 3D Models in Electrical Capacitance Tomography** (Numeryczne symulacje pola elektrycznego dla gęstych modeli 3D w elektrycznej tomografii pojemnościowej).
Jacek Kryszyn;
Mar. 08, 20218 – Oct. 31, 2018

The aim of the research was to develop numerical simulations of the electric field for dense 3D models in electrical capacitance tomography. The elaborated method had to take into account the rare nature of the matrix describing the electrical potentials in the model's voxels. The developed method was compared with the methods used so far in the simulation tools developed by our team to investigate the time and quality of the simulation. Next, three-dimensional reconstruction was implemented using the sensitivity matrices generated using simulated electric field distributions. The tests were carried out using numerically simulated data and data obtained through measurements of the developed test objects. Numerical simulations were carried out using the ECTsim 3.0 package, created and developed by our team in MATLAB. This package allowed modeling of capacitance tomography sensors and phantoms, simulations of electric field in three-dimensional space, simulations of measurements and image reconstruction. The actual measurements were obtained using the EVT4 capacitance tomograph created by our team.

[Pro35] **Laboratory System for Investigation Non-Linear Audio Signal Processing Systems** (Stanowisko laboratoryjne przeznaczone do badania zjawisk nieliniowych i procesów niestacjonarnych w cyfrowych systemach przetwarzania i odtwarzania sygnałów fonicznych).
Marcin Lewandowski;
Jul. 05, 2018 – Dec. 31, 2018

The aim of this work was to develop a system for analyzing digital audio processing algorithms and digital-to-analog converters in the scope of precise measurements and processing of output signals with time-frequency analysis methods based on signal decomposition (EMD, EEMD, VMD, ITD, SSA, HHSA) and Fourier transform (FDM, SSTFT). The proposed system is able to acquire and analyze digital signals processed in typical audio applications, such as signal processing for improved speech intelligibility, noise reduction, amplitude's quantization, multirate filtering, lossy and lossless coding and signals reproduced in digital-to-analog converters.

4.4. Other projects

[Pro36] **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, P. Brzeski, J. Kryszyn, T. Olszewski, R. Szabatin, M. Stosio, D. Wanta, P. Wróblewski;
Oct. 26, 2015 – Feb. 28, 2018
Funded by Netrix S.A.

The project involved 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.

[Pro37] **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, M. Stosio, D. Wanta, P. Wróblewski;
Oct. 01, 2015 – Feb. 28, 2018
Funded by Netrix S.A.

The project was carried out at Netrix S.A. Research and Development Centre in Lublin. The objective was to build a multimodal electrical tomograph which enables measurement of conductivity and permittivity

spatial distribution. The new image reconstruction methods were also developed. The device would be used for imaging of dumped wall. The prototype device ECITE (Electrical Capacitance and Impedance Tomograph), would enable simultaneous measurement of capacitance and impedance using active surface electrodes. CT hybrid was a modular, compact, configurable, allowing work in various measuring systems.

[Pro38] **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 was to optimize electronic devices for brain-computer interface project. These devices would be used in visual simulation of activity the main parts of the human brain.

[Pro39] **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 was to conduct research studies and construct the prototypes of EEG amplifier and BCI appliance device enable to conduct simultaneous measurement of brain activity.

[Pro40] **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 result of project will be the device able to support modern measurement techniques for very high frequency ranges.

[Pro41] **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 was to provide support in the design of wireless sensors.

[Pro42] **Scientific Studies on the Intelligent Development European Fund „Electrical Tomograph for Innovative Imaging and Area Monitoring Using Node Potentials Map"** (Wykonanie usługi badawczej w projekcie z Funduszu Europejskiego Inteligentny Rozwój pt. "Tomograf elektryczny do innowacyjnego obrazowania i monitorowania obszarowego z wykorzystaniem mapy potencjałów węzłowych").
Waldemar Smolik, P. Brzeski, J. Kryszyn, T. Olszewski, R. Szabatin, M. Stosio, D. Wanta, P. Wróblewski;
Jan. 01, 2018 – Jan. 01, 2020
Funded by NETRIX S.A.

The main goal of the project is to create a mobile tomographic system for 3D imaging and area monitoring using the node potential map. The system will consist of a mobile device that allows the simultaneous recording of electrical potentials of cardiac activity and lung ventilation.

[Pro43] **Use of the Microwave Measuring Equipment: VNA and Power Meter with the Testing Instrumentation** (Udostępnienie mikrofalowej aparatury pomiarowej: analizatora sieci, miernika mocy do realizacji badań, pomiarów i projektów).
Wojciech Wojtasiak, D. Gryglewski, P. Korpas, D. Rosołowski;
Feb. 01, 2018 – Apr. 30, 2018
Funded by Qwed sp.z.o.o.

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

[Pro44] **Design and Implementation of BTS Localization Algorithm based on Measurement Results Obtained with Moble Stations** (Opracowanie i implementacja algorytmu lokalizacji BTS na podstawie wyników pomiarów realizowanych przez terminale sieci komórkowej).
Jerzy Kołakowski, J. Cichocki, V. Djaja-Jośko, M. Kołakowski;
Aug. 15, 2018 – Nov. 30, 2018
Funded by NOTEL POLAND sp.z.o.o.

The work was carried out in cooperation with Notel Poland, Warsaw based company offering services and solutions for telecommunications sector. The work consisted in designing and implementing an algorithm, that would enable BTS localization based on measurements performed by Mobile Stations. The result of the project was a part of RFBENCHMARK – Notel's public portal allowing access to independent measurements and benchmarking of Coverage and Service Quality offered by service providers.

[Pro45] **Research and Development of the Mobile Contacless Payments System Based on the BlueTooth Technology for Merchants, Billing Agents and Consumers Equipped with Mobile Device** (Wykonanie prac badawczych i rozwojowych związanych z systemem mobilnych płatności

zbliżeniowych opartych o technologię Blu-eTooth przeznaczonych dla akceptantów, agentów rozliczeniowych oraz konsumen-tów dysponujących dowolnym urządzeniem mobilnym).
Andrzej Rychter, W. Obrębski;
Dec. 20, 2018 – May 31, 2019
Funded by Braintri sp.z.o.o.

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

[Pro46] **Construction the Field-Effect Transistors Integrated to Broadband Antenna at 640 GHz** (Wytworzenie tranzystorów polowych zintegrowanych z anteną szero-kopasmową pracującą w częstotliwości 640 GHz).
Paweł Kopyt;
Nov. 27, 2018 – Dec. 06.2018
Funded by Wojskowa Akademia Tech-niczna (Military University of Technology).

The main aim of this project was to elaborate the field-effect transistors integrated to broadband antenna worked at 640 GHz. Few technological aspects were taken into account, including influence of material characterization and layer inspection. Appropriate simulation analysis and experimental verification were performed.

[Pro47] **Imaging Studies of Small Animal Brain Using MRI Techniques** (Badania obrazo-we mózgu małych zwierząt z wykorzysta-niem techniki MRI).
Piotr Bogorodzki, E. Piątkowska-Janko, B. Kossowski;
Jun. 20, 2018 – Sept. 20, 2019
Funded by Neurovet Małgorzata Mikuła.

The project is carried out in collaboration of Neurovet and the Faculty of Veterinary Medicine, Warsaw Uni-versity of Life Science. The objective of it is to conduct researches on small animal brain by means of MRI techniques.

[Pro48] **Microwave Characterization of Material Samples with an Open-Ended Coaxial Probe** (Charakteryzacja mikrofalowa pró-bek materiałów metodą otwartej linii współ-osiowej).
Bartłomiej Salski;
Dec. 10. 2018 -Dec. 21, 2018
Funded by Instytut Chemii Przemysłowej (Industrial Chemistry Research Institute).

The aim of this work is to determine electric properties of selected liquids delivered by the Industrial Chemis-try Research Institute in the microwave band.

4.5. Other activities

4.5.1. Scholarship for the outstanding young scientist granted by the Minis-try 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 compo-nents.

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 mem-ber 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 infor-mation data at high speed, to provide efficient inte-grated factory and process automation. The collabora-tion with the Association is realized by the Divi-sion of Nuclear and Medical Electronics.

National Co-operation

MultiShow Cluster
The Institute of Radioelectronics and Multimedia Technology has been designed a cross-regional initia-tive called: "MultiShow Solution for Sports & Leisure Facilities Cluster"; Partner - Polish Association for Sports and Leisure Facilities IAKS Polska is a profes-sional 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 plat-form: "Intelligent Devices and Systems for Distributed Power Generation" is carried out at Institute of Radio-electronics and Multimedia Technology, Military Uni-versity of Technology, National Institute of Telecom-munications, Military Communication Institute, Na-tional Chamber of Electronics and Telecomunications, TP SA., Institute of Electron Technology. The main aim of this project is to conduct the research on tech-nologies 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 Multi-media Technology, Institute of Telecommunications), Faculty of Transport, Faculty of Administration and Social Sciences, Faculty of Automotive and Construc-tion 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 Multime-dia 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

COST Action CA16220: European Network for High Performance Integrated Microwave Photonics

EU Framework Programme HORIZON 2020

Yevhen Yashchyshyn;
2018 - 2022
The WG2 and WG3 are realized in frame of the European Network for High Performance Integrated Microwave Photonics Project.
WG2: The goal is to define the main requirements for implementing IMWP communication and radar subsystems in terms of PIC models and monolithic integration.
WG3: The goal is to identify the IMWP opportunities in terms of generation, SWaP, bandwidth, and integration to unlock the future 5G communications.

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.

4.5.4. 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
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 - 2018
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.

5. TITLES AND DEGREES AWARDED

5.1. Ph.D. Degrees

[PhD1] Konrad Godziszewski: *„Charakteryzacja materiałów dielektrycznych w zakresie częstotliwości subterahercowych"* (Characterization of dielectric materials in the subterahertz frequency range), Prof. **Y. Yashchyshyn** (supervisor), with honours, Warsaw, Jan. 30, 2018.

[PhD2] Marek Kowalski: *"Localization and tracking of facial landmarks in images and video sequences"* (Lokalizacja i śledzenie punktów charakterystycznych twarzy w obrazach i materiałach wideo), Prof. **W.Skarbek** (supervisor), with honours, Warsaw, Nov. 27, 2018.

[PhD3] Jacek Kryszyn: *"Trójwymiarowa akwizycja danych w elektrycznej tomografii pojemnościowej"* (3D data acquisition in electrical capacitance tomography), Prof. **W. Smolik** (supervisor), Warsaw, Dec. 18, 2018.

[PhD4] Paweł Mazurek: *"Bayesian solutions of problems related to non-invasive and non-intrusive monitoring of elderly persons"* (Bayesowskie rozwiązania problemów związanych z nieinwazyjnym i nieuciążliwym monitorowaniem osób starszych), Prof. **R. Z. Morawski** (supervisor), with honours, Warsaw, Nov. 27, 2018.

5.2. M.Sc. Degrees

[MSc1] Olga Błażejewska: *"Analiza parametryczna obwiedni sygnału osłuchowego płuc"* (Parametric analysis of the signal envelope of the respiratory signal), Assoc. Prof. **K. Snopek** (supervisor).

[MSc2] Maurycy Brenner: *"Opracowanie i badanie subterahercowej szerokopasmowej płytki strefowej Fresnela"* (Development and examination of wideband Frensel zone plate), Assist. Prof. **P. Bajurko** (supervisor).

[MSc3] Damian Chamot: *"System przewidywania zagrożenia lawinowego z wykorzystaniem sztucznej inteligencji"* (Prediction of avalanche dangers using artificial intelligence methods), Prof. **P. Bilski** (supervisor).

[MSc4] Xin Chang: *"Facial expressions recognition by animated motion of Candide 3D model"* (Rozpoznawanie emocji twarzy człowieka na podstawie animacji modelu Candide 3D), Prof. **W. Skarbek** (supervisor), studies in English.

[MSc5] Francisco Lopez Domenech: *"Adaptive algorithms for channel equalization in wireless communication"* (Adaptacyjne algorytmy korekcji kanałów w komunikacji bezprzewodowej), Assoc. Prof. **K. Jędrzejewski** (supervisor), studies in English.

[MSc6] Putria Febriana: *"Personalization of Candide 3D model for human – computer interfacing"* (Personalizacja 3D modelu Candide dla potrzeb interfejsu człowiek - komputer), Prof. **W. Skarbek** (supervisor), studies in English.

[MSc7] Paweł Gorgoń: *„Badania wpływu realizacji analogowej części fonicznego przetwornika C/A na jego parametry i jakość dźwięku"* (Study on impact of analog part implementation of audio DAC for its performance and sound quality), Senior Lecturer **P.Bobiński** (supervisor).

[MSc8] Salomea Grodzicka: *"Badanie algorytmów analizy czasowo-częstotliwościowej sygnałów niestacjonarnych w technice dźwiękowej"* (Research on time-frequency analysis methods of non-stationary signals in audio engineering), Assist. Prof. **M. Lewandowski** (supervisor).

[MSc9] Cezary Haliniarz: *"Aplikacja do personalizacji diety"* (Application for diet personalization), Prof. **A. Przelaskowski** (supervisor).

[MSc10] Patryk Hoffman: *„Badanie anteny przestrajanej przełącznikami MEMS"* (Research of antenna with resonating frequency switched by MEMS), Prof. **Y. Yashchyshyn** (supervisor).

[MSc11] Maciej Jasiński: *„Pomiary funkcji HRTF w sferycznym układzie współrzędnych"* (Measurements of HRTFs in spherical coordinate system), Prof. **J. Żera** (supervisor).

[MSc12] Magda Jaworowska: *„Technologia i charakteryzacja modyfikowanych struktur ISFET na potrzeby detekcji awidyny"* (Technology and characterisation of modified ISFET structures for the purpose of avidin detection), Assist. Prof. **P. Firek** (supervisor), M.Sc. degree with honours.

[MSc13] Adrian Juś: *„Pulsoksymetr ze sterowaniem mikrokontrolerowym"* (Pulse oximeter with microcontroller control), Assist. Prof. **G. Domański** (supervisor), M.Sc. degree with honours.

[MSc14] Katarzyna Kelm: *"Rezonansowa przetwornica napięcia stałego na zakres megahercowy"* (Resonant power conventer for megahertz frequences), Assist. Prof. **M. Mikołajewski** (supervisor).

[MSc15] Izabela Kępka: *„Porównanie metod detekcji ruchu"* (Comparison of motion detection methods), Assist. Prof. **J. Naruniec** (supervisor).

[MSc16] Katsiaryna Klaczkow: *"Systemy sterowania instalacjami multimedialnymi"* (Audiovisual control systems), Assist. Prof. **J. Naruniec** (supervisor), M.Sc. degree with honours.

[MSc17] Łukasz Klimowicz: *„Opracowanie systemu transmisji danych diagnostycznych ultra-szerokopasmowego systemu lokalizacyjnego"* (Development diagnostic data collection and presentation subsystem for ultrawideband localization system), Assist. Prof. **J. Kołakowski** (supervisor), M.Sc. degree with honours.

[MSc18] Michał Knap: *„Symulacja wirtualnej minigammakamery"* (Simulation of virtual minigammacamera), Assist. Prof. **G. Domański** (supervisor).

[MSc19] Michał Koc: *"Rezonansowa przetwornica napięcia stałego ze wzmacniaczem klasy E"* (Resonant DC/DC converter with a class E amplifier), Assist. Prof. **M. Mikołajewski** (supervisor).

[MSc20] Karolina Kościelska: *„Ocena metod obliczania osłon radiologicznych w pracowniach rentgenowskich"* (Evaluation of X-Ray radiation shield calculation methodology in radiology departments), Assist. Prof. **G. Domański** (supervisor).

[MSc21] Grzegorz Kowalski: *„Wireless EMG system to recognize hand gestures"* (Bezprzewodowy system EMG do rozpoznawania gestów dłoni), Assist. Prof. **G. Domański** (supervisor).

[MSc22] Natalia Kyc: *"Cykliczna funkcja autokorelacji i cykliczne widmo sygnału EEG"* (Cyclic autocorrelation function and cyclic EEG signal spectrum), Assist. Prof. **P. Firek** (supervisor).

[MSc23] Anna Lejk: *"System do pomiaru właściwości impedancyjnych tkanki"* (Tissue impedance measurement system), Assist. **R. Kurjata** (supervisor).

[MSc24] Patrycja Maciocha: *„Subiektywna ocena jakości sygnałów fonicznych"* (The subjective assessment of audio signals quality), Assist. Prof. **M. Lewandowski** (supervisor).

[MSc25] Michał Mainka: *„System do identyfikacji odbiorników energii elektrycznej w gospodarstwie domowym"* (System for identification of electricity appliances in a household), Prof. **W. Winiecki** (supervisor).

[MSc26] Bartłomiej Myszyński: *„Cyfrowy demodulator sygnałów I/Q z wykorzystaniem USB 3.0 Digital"* (Q demodulator with USB 3.0 standard), Assoc. Prof. **P. Kopyt** (supervisor).

[MSc27] Eryk Najduchowski: *"System do automatycznego masteringu materiału dźwiękowego"* (Automatic audio mastering system), Assist. Prof. **M. Lewandowski** (supervisor).

[MSc28] Mateusz Dariusz Nogal: *„Ocena asymetrii w badaniach mammograficznych"* (The assessment of bilateral asymmetry in mammograms), Prof. **A. Przelaskowski** (supervisor).

[MSc29] Urszula Nowakowska: *„Technologia i charakteryzacja modyfikowanych struktur ISFET na potrzeby detekcji BSA"* (Technology and characterization of modified ISFET structures for the purpose of BSA detection), Assist. Prof. **P. Firek** (supervisor).

[MSc30] Anna Orzechowska: *"Bazodanowa identyfikacja białek w środowisku rozproszonym"* (Database searching for protein identification in distributed computing), Assist. **R. Kurjata** (supervisor), M.Sc. degree with honours.

[MSc31] Adam Pacewicz: *"Spektroskopia rezonansu ferromagnetycznego cienkich warstw w zakresie mikrofal"* (Ferromagnetic resonance spectroscopy of thin films at microwave frequencies), Assoc. Prof. **B. Salski** (supervisor), M.Sc. degree with honours.

[MSc32] Paulina Paluch: *„Wpływ korekcji geometrycznej na wyniki badań populacyjnych techniką MRI"* (The impact of geometric distortion correction on the results of population MRI study), Assist. Prof. **E. Piątkowska-Janko** (supervisor).

[MSc33] Sławomir Rymaszewski: *"Steganografia w dziedzinie DCT"* (Steganography in DCT domain), Prof. **W. Skarbek** (supervisor).

[MSc34] Monika Selegrat: *"Uśrednione modele sygnałów EMG uzyskiwane w procesach cyklicznych"* (Averaged EMG signal models obtained in cyclic processes), Assist.Prof. **J. Dusza** (supervisor).

[MSc35] Maurycy Jan Sota: *„Symulacja rozwoju pożarów i wizualizacja w środowisku rzeczywistości wirtualnej"* (Fire spread simulation and visualization in virtual reality), Assist. Prof. **G. Galiński** (supervisor).

[MSc36] Krzysztof Szczypior: *„Urządzenie do monitorowania przyspieszeń do celów biomechanicznych"* (Device for monitoring accelerations for biomechanical purposes), Assist. Prof. **G. Domański** (supervisor).

[MSc37] Paweł Szymański: *„X2M - biblioteka Matlab wykorzystująca Representational State Transfer (REST) do neuroobrazowych badań populacyjnych"* (X2M - Matlab library using the Representational State Transfer (REST) for neuroimaging population studies), Prof. **P. Bogorodzki** (supervisor).

[MSc38] Rafał Mateusz Trojak: *„Analiza danych epidemiologicznych z wykorzystaniem architektury Big Data"* (Analysis of epidemiological data in Big Data environment), Assist. **R. Kurjata** (supervisor).

[MSc39] Artur Tynecki: *„Medyczny system wymiany danych z wykorzystaniem technologii bezprzewodowych NFC i Wi-Fi"* (The medical data exchange system based on wireless technologies NFC and Wi-Fi), Assist. **R. Kurjata** (supervisor), M.Sc. degree with honours.

[MSc40] Karolina Walędzik: *„Analiza i wstępna klasyfikacja sygnału EKG"* (The analysis and premedical classification of ECG signal), Assist. Prof. **G. Domański** (supervisor), M.Sc. degree with honours.

[MSc41] Maciej Wardziak: *"Oprogramowanie odbiornika pomiarowego emisji DRM"* (Measurement receiver software of a DRM signal), Assist. Prof. **W. Kazubski** (supervisor).

[MSc42] Bartosz Wilk: „*Analiza danych pomiarowych dźwięku/drgań i ich przeglądanie w technologii webowej*" (The analysis of sound/vibration data and its presentation in a web technology), Senior Lecturer **A. Podgórski** (supervisor).

[MSc43] Paweł Wiśniewski: „*Narzędzie do półautomatycznej segmentacji obrazów MRI serca*" (Tool for semi-automatic segmentation of cardiac MRI images), Assist. Prof. **E. Piątkowska-Janko** (supervisor).

[MSc44] Szymon Wojczakowski: „*Aplikacja internetowa do obsługi systemu monitorowania rytmu serca z funkcją wczesnego wykrywania arytmii*" (The web application to handle a system for monitoring and analysing the heart rate with the function of early detection of arrhythmia), Assist. **R. Kurjata** (supervisor).

[MSc45] Ewa Anna Woźny: *"Opracowanie sterownika systemu lokalizacyjnego platformy wsparcia osób z demencją"* (Development of a localization system controller for the platform supporting people with dementia), Assist. Prof. **J. Kołakowski** (supervisor), M.Sc. degree with honours.

[MSc46] Katarzyna Wynimko: *"Badania i ocena ryzyka wystąpienia ubytków słuchu spowodowanych głośnym słuchaniem muzyki w słuchawkach"* (Research and estimation of the risk of hearing loss caused by loud listening to music through the phones), Senior Lecturer **P. Bobiński** (supervisor), M.Sc. degree with honours.

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

[MSc47] Adrian Krawczyk: *"Urządzenie do zdalnego monitorowania warunków środowiskowych z łączem radiowym"* (Device for remote monitoring of environmental conditions with radio link), Assist. Prof. **G. Domański** (supervisor).

5.4. B.Sc. Degrees

[BSc1] Jakub Jan Buraczyk: *"Interfejs www dla elektrycznego tomografu pojemnościowego"* (WWW interface for electrical capacitance tomograph), Assist. **J. Kryszyn** (supervisor).

[BSc2] Paweł Chrastina: *"Opracowanie narzędzia do analizy parametrów przebiegów elektrycznych pochodzących z pomiarów odbiorników energii elektrycznej"* (Development of tool for analyzing parameters of electrical waveforms from measurements of electrical loads), Prof. **W. Winiecki** (supervisor).

[BSc3] Jerzy Wiktor Cuper: *"Projekt, wykonanie i charakteryzacja zestawu aperturowych anten Vivaldiego"* (Project, fabrication and characterization of set of double ridged horn antennas), Assoc. Prof. **B. Salski** (supervisor), B.Sc. degree with honours.

[BSc4] Agnieszka Maria Czaplicka: *"Zastosowanie sztucznych sieci neuronowych do identyfikacji białek w eksperymentach proteomicznych"* (The use of artificial neural networks for identification of proteins in proteomic experiments), Assist. Prof. **T. Rubel** (supervisor).

[BSc5] Nam Hai Dang: *"Opracowanie w języku C modelu toru nadawczego satelitarnej telewizji cyfrowej standardu DVB-S2"* (Software implementation of the transmission path of digital satellite television standard DVB-S2 in C Programming Language), Assist. Prof. **K. Kurek** (supervisor).

[BSc6] Martyna Sara Dybowska: *"Internetowy kreator życiorysów"* (Web application for creating résumées), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc7] Krzysztof Łukasz Dygnarowicz: *"Interfejs akwizycyjny do mini-gammakamery"* (Mini-gammacamera acquisition interface), Assist. Prof. **R. Szabatin** (supervisor).

[BSc8] Marika Dziuba: „*Komputerowe odkrywanie wiedzy w medycynie*" (Computerized knowledge discovery in medicine), Prof. **J. Mulawka** (supervisor).

[BSc9] Konrad Kamil Frąc: *"Aplikacja bazodanowa do ewidencji danych procesu powstawania mierników"* (Database application for data records of the meter production proces), Senior Lecturer **A. Podgórski** (supervisor).

[BSc10] Patryk Frączek: *"Implementacja sprzętowa konwerterów wizyjnych typu rozdzielczość – liczba strumieni"* (Hardware implementation of vision converters between resolution and number of streams), Prof. **G. Pastuszak** (supervisor).

[BSc11] Maciej Gajewski: "*Program dokładnego obliczania wykorzystania zasobów symulatorów EM dla systemu komputerowego*" (A program for the exact calculation of the use of EM simulator resources for a computer system), Assist. Prof. **M. Sypniewski** (supervisor).

[BSc12] Jakub Jan Gawlik: *"Projekt układu antenowego pracującego na pasmo 24 GHz w technologii LTCC"* (Antenna system project operates at a frequency of 24 GHz in LTCC technology), Prof. **Y. Yashchyshyn** (supervisor).

[BSc13] Arkadiusz Piotr Grzybek: *"Odbiornik systemu radionawigacji VOR"* (Receiver for VOR navigational system), Assist. Prof. **W. Kazubski** (supervisor).

[BSc14] Piotr Harakop: *"Opracowanie przyrządu do pomiaru współczynnika pochłaniania dźwięku"* (Development of a device for measurement of sound absorption coefficient), Prof. **J. Żera** (supervisor).

[BSc15] Radosław Marek Helon: *"Implementacja graficznego interfejsu użytkownika radiotelefonu amatorskiego"* (Implementation of

the graphical user interface of an amateur radiotelephone), Assist. Prof. **P. Korpas** (supervisor).

[BSc16] Arkadiusz Hryb: *"Projekt oraz implementacja systemu rozpoznawania mowy"* (Project and implementation of voice recognition system), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc17] Michał Remigiusz Janczyk: *"Detekcja i rozpoznawanie stanu sygnalizatorów świetlnych"* (Detection and recognition of the status of traffic lights), Assist. Prof. **A. Buchowicz** (supervisor).

[BSc18] Zofia Jethon: *"Oprogramowanie wspomagające projektowanie ustrojów akustycznych"* (Software supporting the design of acoustic structure), Senior Lecturer **P. Bobiński** (supervisor).

[BSc19] Przemysław Jóźwik: *„Opracowanie symulatora toru nadawczo-odbiorczego standardu DVB-S2 z wykorzystaniem Matlaba"* (Implementation of DVB-S2 transmitter and receiver simulator in Matlab environment), Assist. Prof. **K. Kurek** (supervisor).

[BSc20] Adam Grzegorz Kaczor: *"Pakiet procedur do populacyjnych badań jądrowego rezonansu magnetycznego rdzenia kręgowego"* (The package of procedures in population studies using magnetic resonance imaging of spinal cord), Prof. **P. Bogorodzki** (supervisor).

[BSc21] Paweł Kaniewski: *"Przenośny miernik promieniowania UV"* (Portable UV radiation meter), Assist. **R. Kurjata** (supervisor).

[BSc22] Adam Kapuściński: *"Anonimizacja wysokorozdzielczych badań pochodzących z rezonansu magnetycznego"* (Anonymisation of high-resolution studies from magnetic resonance imaging), Assist. Prof. **E. Piątkowska-Janko** (supervisor).

[BSc23] Klaudia Kaźmierska: *"Opracowanie stanowiska do automatycznych pomiarów generatorów odniesienia"* (Automatic test arrangement for reference generator measurements), Reader **J. Cichocki** (supervisor).

[BSc24] Kacper Kępiński: *„Przyjazny urządzeniom mobilnym internetowy serwis informacji medycznej dla przychodni"* (Mobile friendly Internet service of medical information for clinic), Assist. **R. Kurjata** (supervisor).

[BSc25] Jędrzej Wojciech Klocek: *„Aplikacja mobilna prezentująca mapy pokrycia sygnałem nadajników RTV"* (A mobile application that presents coverage maps with RTV signals), Assist. Prof. **P. Korpas** (supervisor).

[BSc26] Antoni Kochanowski: *„Projekt i realizacja albumu muzycznego w domowym studio nagrań"* (Project and realization of a music album in a home recording studio), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc27] Aleksandra Kot: *"Procedury definicji geometrii obiektów w oprogramowaniu do numerycznego modelowania w elektrycznej tomografii pojemnościowej"* (Procedures of object geometry definition in numerical modeling software for electrical capacitance tomography), Prof. **W. Smolik** (supervisor).

[BSc28] Adam Klekotko:*"Cykliczna funkcja autokorelacji i cykliczne widmo sygnału EEG"* (Device for measuring tissue impedance), Assist. Prof. **G. Domański** (supervisor).

[BSc29] Robert Tomasz Kołakowski: *„Aplikacja do analizy odpowiedzi impulsowej kanału UWB"* (Software for UWB channel impulse response analysis), Reader **J. Cichocki** (supervisor).

[BSc30] Aleksandra Kot: *„Procedury definicji geometrii obiektów w oprogramowaniu do numerycznego modelowania w elektrycznej tomografii pojemnościowej"* (Procedures of object geometry definition in numerical modeling software for electrical capacitance tomography), Prof. **W. Smolik** (supervisor).

[BSc31] Michalina Kryjan: *„Filtracja obrazu w celu zwiększenia jakości obrazowania tęczówki oka"* (Image filtration to improve quality of iris imaging), Prof. **A. Pacut** (supervisor).

[BSc32] Patryk Kulpanowski: *„Interfejs LabVIEW do obsługi elektrycznego tomografu pojemnościowego EVT4"* (LabVIEW interface for operation of the EVT4 electric capacitance tomograph), Assist. **J. Kryszyn** (supervisor).

[BSc33] Dawid Kusiak: *"Aplikacja typu "przewodnik turystyczny" na urządzenia przenośne"* (Tourist guide application for mobile devices), Assist. Prof. **G. Galiński** (supervisor).

[BSc34] Kamil Lipiński: *"Organizacja, udostępnianie i przetwarzanie obrazowych danych medycznych z wykorzystaniem platformy XNAT"* (Organization, sharing and processing of medical image data with XNAT platform), Prof. **P. Bogorodzki** (supervisor).

[BSc35] Katarzyna Karolina Lis: *„Komputerowa symulacja wyników pooperacyjnych po zabiegach przemieszczenia ścięgna"* (Computer simulation of the post - surgical results of tendon transfer surgery), Assoc. Prof. **M. Kwacz** (supervisor).

[BSc36] Kinga Lesicz: *„Analiza sygnałów EMG mięśni ręki"* (Analysis of EMG signals from arm muscles), Assist. Prof. **Z. Wawrzyniak** (supervisor).

[BSc37] Michał Jan Łucjan: *„Opracowanie układu transmisji danych zgodnego ze standardem LoRa"* (Data transmission system compliant with the LoRa standard), Assist. Prof. **J. Kołakowski** (supervisor).

[BSc38] Adrianna Maczuga: *„Moduł do stabilizacji temperatury detektorów SiPM z magistralą RS-485"* (Module to stabilise the temperature of SiPM using the RS-485 standard), Assist. Prof. **A. Rychter** (supervisor).

[BSc39] Mateusz Majkowski: *„Modelowanie rozkładu pola w zagęszczanej siatce kartezjańskiej w elektrycznej tomografii pojemnościowej – procedury w języku Matalb dla pakietu Ectsim"* (Modelling of electric field distribution using refined Cartesian mesh in electrical capacitance tomography – Matlab procedures for Ectsim), Prof. **W. Smolik** (supervisor).

[BSc40] Łukasz Maksimowski: *„Wirtualny przyrząd pomiarowy w technologii Java"* (Java-based virtual measuring instrument), Assist. **R. Łukaszewski** (supervisor)

[BSc41] Kamila Mańkowska: *„Analiza zmian właściwości dynamicznych w chodzie patologicznym"* (Analysis of changes in dynamic properties in pathological gait), Assist. Prof. **Z. Wawrzyniak** (supervisor).

[BSc42] Weronika Michaluk: *„Projekt i budowa części sprzętowej bezprzewodowego systemu EKG"* (Design and construction of wireless EKG system hardware), Assoc. Prof. **K. Jędrzejewski** (supervisor), B.Sc. degree with honours.

[BSc43] Karolina Michoń: *„Aplikacja webowa do prezentacji danych pomiarowych z laboratorium wzorcującego mierniki poziomu dźwięku"* (Web application for presenting measurement data from a laboratory calibrating sound metres), Senior Lecturer **A. Podgórski** (supervisor).

[BSc44] Michał Mroczek: *„Aplikacja wspomagająca czytanie z wykorzystaniem algorytmu analizy kierunku patrzenia"* (Support reading application using gaze tracking algorithm), Assist. Prof. **J. Naruniec** (supervisor).

[BSc45] Małgorzata Maria Murach: *„Nowe protezki ucha środkowego typu PORP i TORP"* (New middle ear prosthesis PORP and TORP), Assoc. Prof. **M. Kwacz** (supervisor).

[BSc46] Malwina Maria Nesteruk: *„Porównanie wybranych metod selekcji cech"* (Comparison of feature selection methods), Assist. Prof. **P. Płoński** (supervisor).

[BSc47] Paweł Orłowski: *"Badanie zależności złożoności aktywności elektrofizjologicznej mózgu od ilości przetwarzanej informacji"* (Study of the dependence of the complexity of brain electrophysiological activity on the amount of processed information), Prof. **M. Nałęcz** (supervisor).

[BSc48] Natalia Osiadała: *"Moduł przemiany częstotliwości do zastosowania w szyku antenowym z modulacją czasową"* (Frequency conversion module for a time-modulated antenna array), Prof. **Y. Yashchyshyn** (supervisor).

[BSc49] Artur Paweł Osiak: *„Wzmacniacz lampowy z aktywną kompensacją przydźwięku sieciowego"* (Vacuum tube amplifier with active compensation of a power supply noise), Assist. Prof. **G. Makarewicz** (supervisor), Warsaw University of Technology Distant Learning Center (Ośrodek Kształcenia na Odległość PW).

[BSc50] Katarzyna Ostrowska: *„Symulacja biomechaniki układu mięśniowo-szkieletowego dla wybranej dyscypliny sportowej"* (Simulation of the biomechanics of the musculoskeletal system for the selected sport), Assoc. Prof. **M. Kwacz** (supervisor).

[BSc51] Piotr Owczarski: *"Moduł oprogramowania do strumieniowania danych wizyjnych z urządzeń mobilnych z systemem Android"* (Video streaming software module for mobile devices with Android system), Assist. Prof. **A. Buchowicz** (supervisor).

[BSc52] Natalia Parkot: *„Rezonansowy wzmacniacz mocy klasy E z tranzystorem typu GaN"* (Resonant class E power amplifier with a GaN transistor), Assist. Prof. **M. Mikołajewski** (supervisor).

[BSc53] Bartłomiej Pawełkowicz: *„Oprogramowanie do zobrazowania zawartości depesz nawigacyjnych GPS współpracujące z programem GNSS-SDR"* (Software for displaying GPS Navigation Message data, cooperating with GNSS-SDR program), Assist. Prof. **W. Kazubski** (supervisor).

[BSc54] Izabela Plucińska: *"System zarządzania informacją laboratoryjną dla pracowni spektrometrii mas"* (Information management system for mass spectrometry laboratory), Assist. Prof. **T. Rubel** (supervisor).

[BSc55] Magdalena Przybył: *„Projekt wymiennych folii rozpraszających dla układu formowania wiązki terapeutycznej mobilnego akceleratora elektronów IntraLine do radioterapii śródoperacyjnej"* (Design of replaceable scattering foils for therapeutic beam forming system in the IntraLine mobile electron accelerator for intraoperative radiotherapy), Prof. **K. Zaremba** (supervisor).

[BSc56] Joanna Pudełko: *„Metoda EMD w obrazowaniu medycznym"* (EMD method in medical imaging), Assoc. Prof. **K. Snopek** (supervisor).

[BSc57] Mateusz Pychewicz: *„Oprogramowanie do przeglądania badań funkcjonalnych rezonansu magnetycznego w standardzie BIDS"* (Software for browsing results of functional magnetic resonance imaging supporting BIDS standard), Assist. **R. Kurjata** (supervisor).

[BSc58] Magdalena Rosochacka: *„Badania symulacyjne w modelu wirtualnego człowieka do analizy narządu ruchu"* (Simulation studies in the virtual human model for the analysis of the musculoskeletal system), Assist. Prof. **Z. Wawrzyniak** (supervisor).

[BSc59] Kacper Michał Roszczyna: *"Mobilna aplikacja wspomagająca układanie jadłospisu"* (Mobile application helping to arrang a personal menu), Senior Lecturer **K. Ignasiak** (supervisor).

[BSc60] Aneta Urszula Sankowska: *„Analiza właściwości chodu przy zniekształceniach kończyn"* (Analysis of gait properties with limb distortions), Assist. Prof. **Z. Wawrzyniak** (supervisor).

[BSc61] Martyna Sawicka: *„Klasyfikacja schorzeń nowotworowych na podstawie danych o aktywności genów przy użyciu sztucznych sieci neuronowych"* (Neural network-based cancer classification using microrray data), Assist. Prof. **T. Rubel** (supervisor).

[BSc62] Mateusz Szymon Socha: *„Serwis internetowy oferujący usługi w zakresie wyznaczania właściwości białek i peptydów na potrzeby badań proteomicznych wykorzystujących spektrometrię mas"* (Internet service for calculating the theoretical properties of proteins and peptides for proteomics research using mass spectrometry), Assist. Prof. **T. Rubel** (supervisor).

[BSc63] Bartosz Sowul: *„Algorytm genetyczny tworzący nowe przestrzenie cech w zadaniach klasyfikacji"* (Genetic algorithm for feature engineering in classification tasks), Assist. Prof. **P. Płoński** (supervisor).

[BSc64] Katarzyna Spalińska: *„Optymalizacja parametrów algorytmów uczących"* (Optimization of machine learning algorithms parameters), Senior Lecturer **T. Olszewski** (supervisor).

[BSc65] Jacek Steć: *"Realizacja węzła sieci IoT dla aplikacji automatyki budynkowej"* (Implementation of an IoT network node for building automation's application), Assist. Prof. **K. Mroczek** (supervisor).

[BSc66] Jakub Szajner: *"Rozproszone zarządzanie budżetem domowym z biometrycznym rozpoznawaniem użytkowników"* (Distributed home budget management with biometric user authentication), Senior Lecturer **K. Ignasiak** (supervisor).

[BSc67] Tomasz Szcześniak: *„Aplikacja webowa do przechowywania, redukcji oraz wizualizacji wielowymiarowych danych medycznych"* (Web application for storing, reduction and visualization multidimensional medical data), Senior Lecturer **T. Olszewski** (supervisor).

[BSc68] Kamil Sebastian Szczypkowski: *„Projekt anteny szczelinowej z rezonatorem dielektrycznym o przełączanej częstotliwości pracy"* (Frequency tunable slot-fed dielectric resonator antenna), Assist. Prof. **K. Derzakowski** (supervisor).

[BSc69] Katarzyna Szmulewicz: *„Urządzenie do akwizycji sygnałów ze scyntykamery"* (Device for acquisition signals from scintillation camera), Assist. Prof. **G. Domański** (supervisor).

[BSc70] Alicja Szybka: *„Analiza zachowania kręgosłupa w chodzie przy obciążeniu"* (Analysis of the behavior of the spine while walking with a load), Assist. Prof. **Z. Wawrzyniak** (supervisor).

[BSc71] Katarzyna Anna Tararuj: *„Pomiary in-situ absorpcji akustycznej materiałów"* (In-situ measurements of acoustic absorption of materials), Prof. **J. Żera** (supervisor).

[BSc72] Rafał Tępiński: *"Symulator szerokopasmowego kanału radiowego z wykorzystaniem techniki SDR"* (Wideband channel simulator with the usage of SDR technique), Assist. Prof. **S. Kozłowski** (supervisor).

[BSc73] Ewelina Anna Trochimiuk: *„Internetowy interfejs użytkownika dla bazodanowego systemu identyfikacji białek"* (Web-based user interface for a database protein identification system), Assist. Prof. **T. Rubel** (supervisor).

[BSc74] Tomasz Wierzbicki: *„System wspomagający pracę wypożyczalni rowerów w architekturze JEE"* (A system, which supports the work of the bicycle rental in JEE architecture), Senior Lecturer **K. Ignasiak** (supervisor).

[BSc75] Marcin Marek Wiśniewski: *„Wzmacniacz niskoszumowy na pasmo X do mikrosatelity"* (X-band low noise amplifier for microsatellite), Assist. Prof. **D. Gryglewski** (supervisor).

[BSc76] Julia Wójtowicz: *„Analiza cyklu EKG z wykorzystaniem filtru własnego pacjenta"* (ECG cycle analysis using the patient's custom filter), Assist. Prof. **J. Dusza** (supervisor).

[BSc77] Inga Zacharska: *„Program do wyznaczania parametrów ruchu i pozycji kolarza w płaszczyźnie czołowej"* (Application for determining cyclist's position parameters from frontal plane view), Assist. Prof. **S. Cygan** (supervisor), B.Sc. degree with honours.

[BSc78] Agnieszka Zalewska: *"Dreny wentylacyjne do ucha środkowego"* (Tympanostomy tubes for the middle ear), Assoc. Prof. **M. Kwacz** (supervisor).

[BSc79] Aleksandra Zgudka: *„Funkcjonalny przegląd różnorodnych form modelowania krzywych i powierzchni w programie Rhinoceros 3D wraz samouczkiem dla początkujących"* (A functional overview of the various forms of curves and surfaces modeling in the Rhinoceros 3D program along with a beginner's tutorial), Prof. **B. Putz-Leszczyńska** (supervisor), Warsaw University of Technology Distant Learning Center (Ośrodek Kształcenia na Odległość PW).

[BSc80] Mikołaj Zieliński: *„Budowa transceivera krótkofalowego wykorzystującego technikę SDR"* (Construction a shortwave transceiver using a SDR technique), Assist. Prof. **W. Kazubski** (supervisor).

[BSc81] Piotr Zięcina: *„Samochodowy rejestrator wideo"* (Car video recorder), Assist. Prof. **A. Buchowicz** (supervisor).

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

[BSc82] Marcin Grabowski: *"Zdalnie sterowany robot jeżdżący z systemem wykrywania kolizji"* (Remote-controlled robot with a collision detection system), Assist. **M. Ziembicki** (supervisor).

[BSc83] Bartłomiej Janiszewski: *„Projekt i realizacja generatora funkcyjnego w zakresie od 1 Hz do 10 MHz z krokiem 1 Hz"* (The design and implementation of a function generator with the range from 1 Hz to 10 MHz with 1 Hz step), Senior Lecturer **H. Chaciński** (supervisor).

[BSc84] Karol Sasin: *"Odbiornik radiofoniczny AM/FM z układem Si4735"* (Radio receiver AM / FM based on Si4735 integrated circuit), Assist. Prof. **W. Kazubski** (supervisor).

[BSc85] Paweł Marcin Stan: *„Nadajnik radiowysokościomierza lotniczego"* (The transmitter of airborne radio altimeter), Assist. Prof. **W. Kazubski** (supervisor).

[BSc86] Karol Piotr Szubski: *"System bezprzewodowego sterowania taśmą LED"* (Wirless control system for LED strips), Assist. Prof. **W. Kazubski** (supervisor).

6. PUBLICATIONS

6.1. Scientific and technical books, chapters in books

[Pub1] M. Krawczyk: "Chirurgiczne leczenie chorych z przerzutami raka jelita grubego do wątroby" (Surgical Treatment of Patients with Metastatic Colorectal Cancer) in: *Rak jelita grubego,* A. Deptała, M. Z. Wojtukiewicz (Eds.), *Termedia Wydawnictwa Medyczne*, Poznań 2018, ISBN 978-83-7988-222-9, issue II, chapter 15, pp. 173-189.

[Pub2] R. Plucińska, M. Łątka, A.Wierzbicka-Wichniak, W.Jernajczyk, G. Domański: "Detection of Sleepiness in Narcolepsy" in: *Advances in Biomedical Research – Selected Topics*, Ł. Biały, I Młynarczuk-Biały (Eds.), *Wydawnictwo Naukowe TYGIEL sp.z.o.o.,* Lublin 2018, ISBN 978-83-65932-55-6, pp. 130-138.

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.

[Pub3] K. Abe (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (304 external authors): "Characterization of Nuclear Effects in Muon-Neutrino Scattering on Hydrocarbon with a Measurement of Final-State Kinematics and Correlations in Charged-Current Pionless Interactions at T2K", *Physical Review D*, vol. 98, 2018, pp. 032003-1-032003-46.

[Pub4] K. Abe (….), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (295 external authors): "First Measurement of the ν_μ Charged-Current Cross Section on a Water Target without Pions in the Final State", *Physical Review D*, vol. 97, 2018, pp. 012001-1-012001-16.

[Pub5] K. Abe (….), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (395 external authors): "Measurement of the Single π^0 Production Rate in Neural Current Neutrino Interactions on Water", *Physical Review D*, vol. 97, 2018, pp. 032002-1-032002-13.

[Pub6] K. Abe (….), R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (322 external authors): "Search for CP Violation in Neutrino and Antineutrino Oscillations by the T2K Experiment with 2.2x1021 Protons on Target", *Physical Review Letters*, vol. 121, 2018, pp. 171802-1-171802-9.

[Pub7] K. Abe (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (297 external authors): "Physics Potentials with the Second Hyper-Kamiokande Detector in Korea", *Progress of Theoretical and Experimental Physics*, vol. 2018, issue 6, 2018, article no. 063C01, doi: 10.1093/ptep/pty044, 65 pp.

[Pub8] C. Adolph (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (207 external authors): "Azimuthal Asymmetries of Charged Hadrons Produced in High-Energy Muon Scattering off Longitudinally Polarised Deuterons", *The European Physical Journal C*, vol. 78, no. 952, 2018, pp. 1-13.

[Pub9] M.Aghasyan (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (296 external authors): "Transverse-Momentum-Dependent Multiplicities of Charged Hadrons in Muon-Deuteron Deep Inelastic Scattering", *Physical Review D*, vol. 97, 2018, pp. 032006-1-032006-23.

[Pub10] M.Aghasyan (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (206 external authors): "Longitudinal Double-Spin Asymmetry A(1) and Spin-Dependent Structure Function g(1)(p) of the Proton at Small Values of x and Q(2)", *Physics Letters B*, vol. 781, 2018, pp. 464-472.

[Pub11] M. Aghasyan (…), M. Dziewiecki, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (212 external authors): "Search for Muoproduction of *X* (3872) at COMPASS and Indication of a New State", *Physics Letters B*, vol. 783, 2018, pp. 334-340.

[Pub12] M. Aghasyan (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (224 external authors): "Light Isovector Resonances in $\pi^- \rho \to \pi^- \pi^- \pi^+ \rho$ at 190 GeV/*c*", *Physical Review D*, vol. 98, 2018, pp. 092003-1-092003-9.

[Pub13] R. Akhunzyanov (…), M. Dziewiecki, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (223 external authors): "K⁻ over K⁺ Multiciplicity Ratio for Kaons Produced in DIS with a Large Fraction of the Virtual-Photon Energy", *Physics Letters B,* vol. 786, 2018, pp. 390-398.

[Pub14] P. Bilski: "Hierarchical Diagnostics of Analog Systems Based on the Ambiguity Groups Detection", *Measurement*, vol. 119, 2018, pp. 1-10.

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[Rep7] K. Ignasiak, W. Skarbek, G. Pastuszak, A. Buchowicz, G. Galiński, J. Naruniec: *„Inteligentne, rozproszone, sieciowe systemy wideo"* (Intelligent, Scattering, Network Video Systems), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, Warsaw, Oct. 2018.

[Rep8] J. Kołakowski, J. Cichocki, V. Djaja-Jośko, M. Kołakowski: *„Wykorzystanie skanera laserowego do badań dokładności i precyzji określania położenia w ultraszerokopasmowym systemie lokalizacyjnym"* (Application of Laser Scanner for Investigation of UWB Positioning System Accuracy and Precision) Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, Warsaw, Oct. 2018.

[Rep9] J. Kołakowski, J. Cichocki, V. Djaja-Jośko, M. Kołakowski: *„Opracowanie i implementacja algorytmu lokalizacji BTS na podstawie wyników pomiarów realizowanych przez terminale sieci komórkowej"* (Design and Implementation of BTS Localization Algorithm based on Measurement Results Obtained with Moble Stations), Final report for NOTEL Poland sp.z.o.o., Warsaw, Nov. 30, 2018.

[Rep10] P. Kopyt: *„Wytworzenie tranzystorów polowych zintegrowanych z anteną szerokopasmową pracującą w paśmie 640 GHz"* (Construction the Field-Effect Transistors Integrated to Broadband Antenna at 640 GHz), Final report for Wojskowa Akademia Techniczna (Military University of Technology), Warsaw, Nov. 2018.

[Rep11] K. Kurek J. Modelski,S. Kozłowski: *„Zastosowanie technik radia programowalnego SDR w realizacji łączności satelitarnej"* (Application of SDR Techniques in Satellite Communications), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, Warsaw, Oct. 2018.

[Rep12] J. Marzec, K. Zaremba, P. Bogorodzki, P. Brzeski, G. Domański, M. Dziewiecki, T. Jamrógiewicz, B. Konarzewski, R. Kurjata, J. Kryszyn, W. Obrębski, T. Olszewski, E. Piątkowska-Janko, D. Radomski, A. Rychter, W. Smolik, M. Ziembicki, B. Kossowski, D. Wanta, M. Wieteska, P. Wróblewski: *„Nowoczesne techniki elektroniki jądrowej i medycznej"* (Modern Techniques in Nuclear and Medical Electronics), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, Warsaw, Oct. 2018.

[Rep13] M. Mikołajewski, H. Chaciński, W. Kazubski: *„Rezonansowe wzmacniacze mocy klasy DE do zastosowań przemysłowych – doskonalenie rozwiązań, analiza i metody projektowania"* (Class DE Resonant Power Amplifiers for Industry Application – Improvement of Solutions, Analysis and Design Methods), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, Warsaw, Oct. 2018.

[Rep14] T. A. Miś, J. Modelski: *"Przygotowania do konstrukcji i badań napowietrznego na-dajnika radiowego pracującego w paśmie VLF oraz systemów telewizyjnych pracujących w widmie wysokoener-getycznym"* (Preparations for the Construc-tion and Testing of an Overhead Radio Transmitter Working in the VLF Band and Television Systems Operating in the High Energy Spectrum), Final report for the Min-istry of Science and Higher Education, Warsaw, Sept. 2018.

[Rep15] R. Z. Morawski, A. Miękina, A. Podgórski: *„Metodologiczne aspekty przetwarzania danych pomiarowych"* (Methodological As-pects of Measurement Data Processing), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Tech-nology, Warsaw, Oct. 2018.

[Rep16] W. Smolik: *"Usługi eksperckie w celu rea-lizacji projektu "Tomograf hybrydowy do badania zawilgocenia i stanu budynków"* (Expert Services to Implement the Project "Hybrid CT Scanner to Examine Buildings Moisture and Condition), Final report for Netrix S.A, Warsaw, Feb. 2018.

[Rep17] W. Smolik, P. Brzeski, J. Kryszyn, T. Ol-szewski, R. Szabatin, M. Stosio, D. Wanta, P. Wróblewski: *„Tomograf hybrydowy do badania zawilgocenia i stanu budynków"* (Hybrid CT Scanner to Examine Buildings Moisture and Condition), Final report for Netrix S.A, Warsaw, Feb. 2018.

[Rep18] K. Snopek, Ł. Błaszczyk, T. Kosiło: *„Bada-nia w dziedzinie przekształceń sygnałów wielowymiarowych oraz nowych systemów radiowej transmisji danych"* (Research on Multidimensional Signal Transformations and Novel Radio Data Transmission Sys-tems), Final report for the statutory grant, Institute of Radioelectronics and Multime-dia Technology, Warsaw, Oct. 2018.

[Rep19] W. Winiecki, P. Bilski, R. Łukaszewski, K. Mroczek, A. Wójcik, K. Dowalla: *„Rozwój metod do monitoringu i diagnostyki urządzeń elektrycznych i systemów analo-gowych"* (Advancement of the Methods for the Monitoring and Diagnostics of Electrical Appliances and Analog Systems), Final re-port for the statutory grant, Institute of Ra-dioelectronics and Multimedia Technology, Warsaw, Oct. 2018.

[Rep20] W. Wojtasiak, S. Rosłoniec, B. Salski, 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 oraz na pasma fal milimetrowych i subterahercowych wspo-magane modelowaniem pól elektromag-netycznych, obwodowym i z zakresu cyfrowego przetwarzania sygnałów"* (Mi-crowave and Optoelectronic Devices De-sign Using Electromagnetic Modelling with Account of the Coupled Physical Effects), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Tech-nology, Warsaw, Oct. 2018.

[Rep21] Y. Yashchyshyn, P. Bajurko, K. De-rzakowski, K. Godziszewski, P. Piasecki, J. Sobolewski, G. Bogdan: *„Rozwój zin-tegrowanych bloków funkcjonalnych dla aplikacji na fale milimetrowe realizowanych w technologii LTCC"* (Development of Inte-grated Functional Block for Millimeter-Waves Applications Realized in the LTCC Technology), Final report for the National Centre for Research and Development, Warsaw, Dec. 2018.

[Rep22] Y. Yashchyshyn, P. Bajurko, K. Derzako-wski, K. Godziszewski, G. Bogdan, D. Ny-zovets, P. Piasecki, J. Sobolewski: *„Bada-nia możliwości wykorzystania anten z modulacją czasową w systemach nad-awczych"* (Investigation of Time Modulated Antenna Arrays for Wireless Transmission Systems), Final report for the statutory grant, Institute of Radioelectronics and Mul-timedia Technology, Warsaw, Oct. 2018.

[Rep23] K. Zaremba, M. Ziembicki, A. Rychter: *„Super-Kamiokande Plus",* Horizon 2020, EU Framework Programme for Research and Innovation, Final report for the Ministry of Science and Higher Education, Nov. 2018.

[Rep24] K. Zaremba, J. Marzec, M. Dziewiecki, G. Domański, B. Konarzewski, R. Kurjata, A. Rychter, M. Ziembicki: *„Eksperyment COMPASS – badanie trójwymiarowej i spi-nowej struktury nukleonu"* (Experiment COMPASS – Study of the Three-Dimensional and Spin Structure of the Nu-cleon), Final report for the National Science Centre, May 2018.

[Rep25] J. Żera, P. Bilski, G. Makarewicz, A. Pie-trzak, M. Lewandowski, P. Bobiński: *„Nowe metody badania jakości i przetwarzania dźwięku"* (New Methods for Testing Sound Processing Quality), Final report for the statutory grant, Institute of Radioelectronics and Multimedia Technology, Warsaw, Oct. 2018.

8. PATENTS AND PATENT APPLICATIONS

[Pat1] G. Bogdan, Y. Yashchyshyn: *„Sposób kształtowania charakterystyki kierunkowej w szyku antenowym z modulacją czasową"* (Methods of shaping directional pattern in the aerial array with time modulation and the aerial with time modulation), application no. P-416239, Feb. 23, 2016, Polish patent no. PAT.230083, date of grant May 11, 2018.

[Pat2] R. Kowalik, W. Winiecki, M. Januszewski, Ł. Nogal, R. Łukaszewski, P. Bilski, P. Bobiński: *„Sposób i urządzenie do identyfikacji odbiorników energii elektrycznej"* (Method and the device for identification of electrical energy receivers), application no. P-417462, Jun. 07, 2016, Polish patent no. PAT.229626, date of grant Mar. 12, 2018.

[Pat3] R. Kowalik, W. Winiecki, K. Dowalla, R. Łukaszewski, A. Wójcik, P. Bilski, Ł. Nogal: *„Urządzenie do identyfikacji odbiorników w sieci zasilania oraz sposób do identyfikacji odbiorników w sieci zasilania"* (Device for the identification of the electrical appliances in the power grid and the method for the appliances identification in the power grid), application no. P.425578, May 17, 2018.

[Pat4] J. Kowalewski, W. Obrębski: *"Przetwornik elektroakustyczny pracujący w środowisku tomografu rezonansu magnetycznego"* (Electroacoustic transducer working in an MRI scanner), application no. P.399146, May 11, 2012, Polish patent no. PAT.231062, date of grant Sept. 14, 2018.

[Pat5] M. Szafran, E. Pawlikowska, E. Pietrzak, E. Bobryk, Y. Yashchyshyn, K. Godziszewski, et al.: *"Sposób wytwarzania przestrajalnych kompozytów ceramika-polimer dla elektroniki wysokich częstotliwości"* (Method for producing tunable ceramics-polymer composites for the high frequency electronics), Polish patent no. PAT.229471, date of grant Mar. 12, 2018.

[Pat6] W. Winiecki, R. Kowalik, R. Łukaszewski, P. Bilski, M. Januszewski, Ł. Nogal, A. Wójcik: *„Sposób i urządzenie do identyfikacji źródła zakłóceń harmonicznych sieci elektroenergetycznej, zwłaszcza spowodowane przez odbiorniki energii"* (Method and the system for identification of a source of harmonic distortions of power network, preferably caused by energy receivers), application no. P-417463, Jun. 07, 2016, Polish patent no.PAT 229627, date of grant, Mar. 12, 2018.

[Pat7] W. Winiecki, R. Kowalik, A. Wójcik, R. Łukaszewski, K. Dowalla, P. Bilski, M.Januszewski: *„Urządzenie do detekcji zmian trybu pracy oraz identyfikacji odbiorników w sieci zasilania oraz sposób detekcji zmian trybu pracy oraz identyfikacji odbiorników w sieci zasilania"* (Device for detecting changes of the operation mode and identification of appliances in the power grid and the method for detecting changes in the operation mode of appliances in the power grid), application no. P.425576, May 17, 2018.

9.   SCIENTIFIC EVENTS

9.1.   Scientific events co-organized by the Institute

[Con1]   *The 8th Microwave and Radar Week: MRW 2018 with parallel conferences: 22nd International Microwave and Radar Conference: MIKON 2018, and Baltic URSI Symposium*, supported by National Committees of the Baltic countries (Poznań, Poland, May 15-17, 2018), J. Modelski (chair of *MRW 2018*, member of the *MIKON 2018* Technical Committee), B. Salski (co-chair, member of the Technical Program Committee), W. Gwarek, W. Wojtasiak, Y. Yashchyshyn (members of the *MIKON 2018* Technical Program Committee), P. Bajurko, G. Bogdan, M. Celuch, J. Cuper, K. Godziszewski, V. Djaja-Jośko, M. Góralczyk, M. Kołakowski, P. Kopyt, P. Korpas, M. Krysicki, K. Kurek, D. Kuchta, P. Miazga, T. A. Miś, A. Pacewicz, P. Piasecki, A. Raniszewski, D. Rosołowski, J. Sobolewski, M. Sypniewski (speakers).

[Con2]   *TMEX 2018 WCP: European Workshop on Water Cherenkov Precision Detectors for Neutrino and Nucleon Decay Physics* (Warsaw, Poland, Sept. 19-21, 2018), M. Ziembicki (member of the Local Organizing Committee), conference has been organized in collaboration with the National Centre for Nuclear Research, Faculty of Electronics and Information Technology WUT, Department of Physics University of Warsaw, and University Autonoma de Madrid.

9.2.   International scientific events

[Con3]   *International Microwave Symposium TPRC Meeting* (Garden Grove, USA, Jan. 14, 2018), P. Kopyt (member of the Technical Committee).

[Con4]   *14th International Conference on Advanced Trends in Radioelectronics, Telecommunicatons and Computer Engineering: TCSET 2018* (Lviv-Slavske, Ukraine, Feb. 20-24, 2018), Y. Yashchyshyn (speaker).

[Con5]   *IEEE Winter Conference on Applications of Computer Vision: WACV 2018* (Lake Tahoe, USA, Mar. 12-15, 2018), M. Kowalski (speaker).

[Con6]   *International Interdisciplinary PhD Workshop: IIPhDW* (Świnoujście, Poland, May 9-12, 2018), J. Kryszyn, D. Wanta (speakers).

[Con7]   *11th European Congress and Exposition on Noise Control Engineering: Euronoise 2018* (Hersonissos, Greece, May 26 – Jun. 1, 2018), J. Żera (session chair).

[Con8]   *The Summer XLIInd IEEE-SPIE Joint Symposium on Photonics, Web Engineering, Electronics for Astronomy and High Energy Physics Experiments* (Wilga, Poland, Jun. 3-10, 2018), W. Skarbek (session chair),R. Pilarczyk, R. Protasiuk, A. Wójcik (speakers).

[Con9]   *The 12th International Conference on Electromagnetic Wave Interaction with Water and Moist Substances: ISEMA 2018* (Lublin, Poland, Jun. 4-7, 2018), T. Karpisz (speaker).

[Con10]   *IEEE Microwave Symposium* (Philadelphia, USA, Jun. 10-14, 2018), J. Modelski (member of IEEE Microwave Theory and Techniques Society Council, session chair, member of the Program Committee), B. Salski, P. Kopyt, T. Karpisz (speakers).

[Con11]   *2018 IEEE 6th International Conference on Microwave Magnetics: ICMM* (Exeter, UK, Jun. 24-27, 2018), A. Pacewicz (speaker).

[Con12]   *Conference "Measurement at the Crossroads"* (Paris, France, Jun. 27-29, 2018), R. Z. Morawski (speaker).

[Con13]   *3rd ITN CELTA Summer School 2018 and 28th International Travelling Summer School (ITSS) on Microwaves and Lightwaves* (Prague, Czech Republic, Jul. 7-13, 2018), Y. Yashchyshyn, D. Nyzovets, K. Madziar (speakers).

[Con14]   *2018 IEEE International Symposium on Antennas and Propagation* (Boston, USA, Jul. 8-13, 2017), T. Miś (participant).

[Con15]   *Workshop "New and Enhanced Photosensor Technologies for Underground/-Underwater Neutrino Experiments (NEPTUNE)* (Neapol, Italy, Jul. 17-24, 2018), M. Ziembicki (participant).

[Con16]   *2nd International Summer School on Deep Learning* (Genua, Italy, Jul. 23-27, 2018), P. Buczkowski (participant).

[Con17]   *10th International Workshop on Ring Imaging Cherenkov Detectors* (Moscow, Russia, Jul. 29 – Aug. 4, 2018), M. Ziembicki (participant).

[Con18]   *The World Congress on Industrial Process Tomography: WCIPT9* (Bath, United Kingdom, Sept. 2-6, 2018), W. Smolik, D. Wanta (participants).

[Con19]   *The XII World Congress of the International Measurement Confederation: IMEKO 2018* (Belfast, the United Kingdom, Sept. 3-6, 2018), R. Z. Morawski (chair of the International Scientific Programme Committee, member of Advisory Board, Technical Board), W. Winiecki (Polish representative as the vice-president of Polish Society for Measurement, Automatic Control and Robotics), P. Bilski (member of the General Council), P. Mazurek (member of Technical Committee, speaker) J. Wagner (speaker).

[Con20]   *2018 Joint Conference - Acoustics* (Ustka, Poland, Sept. 11-14, 2018), J. Żera (member of the Scientific Committee, session chair), G. Makarewicz, A. Pietrzak, B. Żłobiński (speakers).

[Con21] *IEEE Signal Processing, Algorithms, Architectures, Arrangements, and Applications: SPA 2018* (Poznań, Poland, Sept. 19-21, 2018), Z. Kulka, J. Modelski, W. Skarbek (members of the Scientific Committee).

[Con22] *48th European Microwave Conference: EuMC* (Madrid, Spain, Sept. 23-28, 2018), J. Modelski (session chair, member of the Technical Programme Committee, member of the General Assembly European Microwave Association: EuMA).

[Con23] *10th International Conference on Microwave Materials and Their Applications: MMA* (Osaka, Japan, Oct. 1-4, 2018), P. Kopyt, B. Salski, A. Pacewicz, J. Cuper, M. Rytel, (speakers).

[Con24] *45 Międzynarodowa Konferencja i Wystawa PIKE 2018* (45th International Conference and Exibition) (Łódź, Poland, Oct. 8-10, 2018), J. Modelski (chair of the Programme Committee).

[Con25] *27th Conference on Electrical Performance of Electronic Packaging and Systems* (San Jose, USA, Oct. 13-18, 2018), J. Cuper, M. Rytel (participants).

[Con26] *The 8th International Conference on Electronics, Communications and Networks: CECNeT* (Bangkok, Thailand, Nov. 16-19, 2018), Y. Yashchyshyn (invited speaker).

[Con27] *26th Telecommunications Forum: TELFOR 2018* (Belgrade, Serbia, Nov. 20-21, 2018), V. Djaja-Jośko, M. Kołakowski (speakers).

9.3. National scientific events

[Con28] *Seminarium ITS Polska "Nauka-Biznes, edycja 1"* (Science -Business, the First Edition) (Warsaw, Poland, Mar. 15, 2018), T. Kosiło, J. Jarkowski (session chairs), J. Modelski (speaker), J. Modelski, T. Kosiło, J. Jarkowski: *"Rozwój aplikacji ITS w przestrzeni standardu 5G"* (Development of ITS Application in 5G Standard), oral presentation.

[Con29] *XXXIV Konferencja Elektroniki, Telekomunikacji i Energetyki Studentów i Młodych Pracowników Nauki: SECON 2018* (XXXIVth Conference on Electronics, Telecommunications and Energetics for Students' and Young Scientists') (Warsaw, Poland, Apr. 26-27, 2018), V. Djaja-Jośko, M. Kołakowski (speakers).

[Con30] *XII Konferencja Naukowa: Systemy Pomiarowe w Badaniach Naukowych i w Przemyśle* (XIIth Scientific Conference: Measurement Systems in Research and Industry) (Łagów, Poland, Jun. 10-13, 2018), W. Winiecki (member of the Scientific Committee, speaker), R. Łukaszewski, K. Dowalla, A. Wójcik (speakers).

[Con31] *Krajowa Konferencja Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2018* (National Conference on Radiocommunications and Broadcasting) (Gdańsk, Poland, Jun. 20-22, 2018), J. Modelski (chairman of the plenary session, member of the Program Committee), J.Cichocki, Y. Yashchyshyn (chairmen of sessions, members of the Program Committee), W. Skarbek, (member of the Program Committee), P. Bajurko, P. Bobiński, K. Godziszewski, J. Kołakowski, W. Kazubski, Ł. Klimowicz, T. Kosiło, K. Kurek, K. Radecki, B. Salski, G. Bogdan P. Buczkowski, V. Djaja-Jośko, P. Hoffmann, M. Kołakowski, P. Piasecki, R. Protasiuk, J. Sobolewski, E. Woźny (speakers).

[Con32] *XXXIV Krajowe Sympozjum Telekomunikacji i Teleinformatyki: KSTiT 2018* (XXXIV National Symposium on Telecommunications and Teleinformatics) (Bydgoszcz, Poland, Sept. 12-14, 2018), J. Modelski, W. Skarbek (members of the Programme Committee).

[Con33] *VIII Konferencja EIT-2018 "Wpływ bezprzewodowych technologii teleinformatycznych na życie współczesnego człowieka"* (Influence of Wireless Teleinformation Technologies on Contemporary Man) (Warsaw, Poland, Nov. 28, 2018), J. Jarkowski (vice-chair, conference coordinator), T. Kosiło: *„Przyszłość bezprzewodowych systemów łączności kolejowej"* (Future of Wireless Railway Communication Systems), oral presentation.

[Con34] *19 Seminarium – Radiokomunikacja i Techniki Multimedialne* (19 Seminar: Radiocommunications and Multimedia Technologies) (Warsaw, Poland, Dec. 5, 2018), J. Kołakowski, B. Salski, Y. Yashchyshyn), chairs of the sessions, R. Augustyniak, G. Bogdan, M. Brenner, V. Djaja-Jośko, Ł. Klimowicz, M. Kocon, M. Kołakowski, M. Krysicki, A. Musiał, (speakers).

[Con35] *Philosophy of Science and Formal Methods in Philosophy* (Warsaw, Poland, Dec. 13-14, 2018), the lecture *"Pomiar a modelowanie matematyczne"* (Measurement and Mathematical Modelling), given by R. Z. Morawski.

10. AWARDS AND DISTINCTIONS

State Medals

Medal Złoty za Długoletnią Służbę (Golden Medal for Long-lasting Service).
Krzysztof Derzakowski, Ph.D.,
Maciej Sypniewski, Ph.D.

Medal Komisji Edukacji Narodowej (Medal of the National Education Committee).
Yevhen Yashchyshyn, Prof. D.Sc.,
Jan Żera, Prof. D.Sc.

Awards granted by international conference committees

The distinguished oral presentation given by **Yevhen Yashchyshyn, Prof. D.Sc.**, with deep appreciation and respect for excellent speech, and efforts in charing session at CECNet2018 Conference (Bangkok, Thailand, Nov. 16-19, 2018).

Awards granted by national bodies

Honorary Citizen of Golina city (Honorowy Obywatel miasta Golina, woj. wielkopolskie)
Józef Modelski, Prof. D.Sc.

The distinguished B.Sc. thesis in Best Diploma National Competition granted by the Polish Association of Telecommunication Engineers.
Robert Kołakowski, B.Sc.

Awards of the Rector

Individual I^0 award for the scientific achievements
Roman Z. Morawski, Prof. D.Sc.

Team I^0 award for the scientific achievements.
Stefan L. Hahn, Prof. D.Sc.,
Kajetana M. Snopek, D.Sc.

Team II^0 award for the scientific achievements.
Sebastian Kozłowski, Ph.D.,
Marek Bury, Ph.D.,
Rafał Zawiślak, M.Sc.

Team III^0 award for the scientific achievements.
Waldemar Smolik, D.Sc. Prof.,
Roman Szabatin, Ph.D.,
Piotr Brzeski, Ph.D.,
Jacek Kryszyn, M.Sc.,
Tomasz Olszewski, M.Sc.,
Damian Wanta, M.Sc.,
Mateusz Stosio, M.Sc.,
Przemysław Wróblewski, M.Sc.,
Katarzyna Krzewska, M.Sc.,
Marcin Krzewski, M.Sc.,
Bartłomiej Radzik, M.Sc.

Individual III^0 award for the organizational achievements.
Wiesław Winiecki, D.Sc. Prof.,
Bartłomiej Salski, D.Sc.

Awards in the Students' Paper Competition at international conferences

The award for the paper titled: *"Coordinate Transformation Approach to the Solution of the Fabry-Perot Open Resonator"*, 22nd International Microwave and Radar Conference: MIKON 2018 (Poznań, Poland, May 15-17, 2018)
Tomasz Karpisz, M.Sc.

The award for the paper titled: *"Experience in Developing, Manufacturing and Measurements of LTCC Leaky-Wave Antennas Operated in Milimeter Waves Range"*, 22nd International Microwave and Radar Conference: MIKON 2018 (Poznań, Poland, May 15-17, 2018).
Przemysław Piasecki, M.Sc.

The award for the paper titled: *"A Novel Approach to the Modeling of a Fabry-Perot Open Resonator"*, International Microwave Symposium (Philadelphia, USA, Jun. 11-14, 2018).
Tomasz Karpisz, M.Sc.

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

The distinguished paper titled: *"Badanie wpływu poziomu odbieranego sygnału na wynik pomiaru TDOA w układzie DW1000"* (Investigating the Received Signal Level Impact on Results of TDOA Measurements with DW 1000 Chip), Krajowa Konferencja Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2018 (National Conference on Radiokomunications and Broadcasting) (Gdańsk, Poland, Jun. 20-22, 2018).
Vitomir Djaja-Jośko, M.Sc.

The award for Ph.D. thesis titled: *"Optymalizacja predykcji międzyobrazowej w kodowaniu danych wizyjnych"* (Optimization of Inter-Prediction in Encoding Video Data), Krajowa Konferencja Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2018 (National Conference on Radiokomunications and Broadcasting) (Gdańsk, Poland, Jun. 20-22, 2018).
Maciej Trochimiuk, Ph.D.

The distinguished Ph.D. thesis titled: *"Charakteryzacja materiałów dielektrycznych w zakresie częstotliwości subterahercowych"* (Characterization of Dielectric Materials in the Sub-Terahertz Frequency Range), Krajowa Konferencja Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2018 (National Conference on Radiokomunications and Broadcasting) (Gdańsk, Poland, Jun. 20-22, 2018).
Konrad Godziszewski, Ph.D.

Awards of the students of the Faculty

"Golden Chalk" Award
Mateusz Krysicki, M.Sc.

Scholarships of the Foundation for the Development of Radiocommunications and Multimedia Technologies granted in 2018

For preparing Ph.D. Thesis
Grzegorz Bogdan
Marcin Góralczyk
Marek Kowalski
Mateusz Krysicki
Dawid Kuchta

For preparing M.Sc. Thesis
Jerzy Cuper
Robert Augustyniak
Maurycy Brenner
Łukasz Klimowicz
Michał Kocon
Natalia Lubojemska
Marcin Rytel
Andrzej Musiał
Ewa Anna Woźny

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

SPECIFICATION	2015	2016	2017	2018
academic staff [posts] total	60,23	63,58	60,33	57,5
tenured professors	5,5	5,5	4,5	4
professors	5,5	8,5	9,5	9
associate professors	5	3	2	3
assistant professors	33,65	32,25	29,5	24,5
readers	1	1	1	1
senior lecturers	4,08	5,33	4,33	5,5
assistants	5,5	8	9,5	10,5
Ph.D. students [persons] total	45	38	37	37
with scholarship	34	31	23	25
without scholarship	11	7	14	12
technical and administrative staff [posts] total	17,75	16,75	15,5	14,25
senior R&D associates	1,25	1	1	1,5
R&D associates	5	5	4	2
administrative associates	9,5	8,75	8,5	8,75
service workers	2	2	2	2
temporary staff [persons]	0	2	2	2
library resources books (volumes)	11197	11212	11212	11212
books (titles)	7307	7323	7323	7323
journals (subscribtions)	83	83	83	83
teaching activities basic courses	61	62	63	58
advanced courses	34	30	28	32
other courses	47	50	38	26
international projects, courses and lectures	4	1	1	3
research projects total	48	50	50	48
international	3	3	3	4
granted by the Ministry	21	19	17	17
granted by the University	17	15	14	14
other	8	13	16	13
titles and degrees awarded Prof. titles	0	1	1	0
D.Sc. degrees	3	0	1	0
Ph.D. degrees	5	7	2	4
M.Sc. degree (regular studies + evening studies)	63+2	48+1	48+1	42+1
M.Sc. degree (studies in English)	1	1	3	3
B.Sc. degrees (regular studies + evening studies)	69+5	72+7	80+2	76+5
B.Sc. degrees (studies in English)	2	0	2	0
B.Sc. degrees e-learning	2	3	1	1
publications total	205	208	149	155
sci.-tech. books and chapters in books	2	2	7	2
sci.-tech. papers in journals - total	89	66	73	57
JCR-ICI list (IF>0)	33	37	40	33
MSHE list	52	28	30	16+1*
in other journals	4	9	3	7
sci.-tech. papers in conference proceedings	81	107	55	91
other publications	33	24	11	5
patents and patent applications	3	4	5	5+2
international	1	1	0	0
national	2	3	5	5+2
research reports	24	21	28	25
scientific events attended by the staff	42	41	40	35

*this paper has been published in December 2017, 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)