



**INSTITUTE OF RADIODEVICE
AND MULTIMEDIA TECHNOLOGY**
WARSAW UNIVERSITY OF TECHNOLOGY



FACULTY OF ELECTRONICS AND INFORMATION TECHNOLOGY

ANNUAL REPORT

2020

Warsaw, January 2021

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From the Director

Dear Friends, Colleagues and Partners!

The following Annual Report presents the situation of our Institute after the very unusual Year 2020, when we had to endure multiple changes forced by the coronavirus pandemic. Although the situation is far from normal, today, in the beginning of 2021, we stand strong, ready for tackle future challenges.

Despite the problems with coronavirus significant challenges awaited us and required meticulous preparations. The pandemic has been spreading over the globe for the past Year and had heavy impact on the educational process in our University. Complete transition to e-learning was difficult for both the academic staff and students. Thanks to the significant IT support it was possible to switch to remote activities. The ability to travel was suppressed, decreasing the number of exchange students. Due to the good organization on the University and Institute level, we could continue all duties, also involving foreign students.

The research and publication process was maintained on the high level. First, our staff is involved in four international project funded by the European Commission (Horizon 2020 and TEAM-TECH programs). Also, 23 grants funded by the Ministry of Science and Higher Education are currently processed. The visible outcome of these activities are 52 papers in journals from the JCR list and 10 papers in other journals.

The pandemic stopped many conferences from happening, or forcing to switch to the virtual mode. Fortunately, that did not prevent our staff from participating in multiple events, including the 23rd International Microwave and Radar Conference: (MIKON 2020), or IEEE International Instrumentation and Measurement Technology Conference: I2MTC. Almost 70 papers were published in the conference proceedings. Most events were put on hold, postponed, or transformed into the on-line meetings, but the Institute was able to organize the Microwave and Radar Week (MRW 2020) held on 5-8 October in the Main Building of our University, in the traditional on-site form facilitating on-line participation for those unable to travel. The MRW-2020 included three parallel conferences (MIKON 2020, International Radar Symposium and the Second Baltic URSI Symposium), two thematic workshops, industrial exhibitions, and the first-ever in Poland Women in Microwaves event. Special gratitude goes to Mateusz Krysicki for his devotion to the organizational effort.

The transition in the didactic process, regarding the NERW and NERW2 initiatives has reached its final stage. New programs have been implemented, including the ones where our Institute's input is very significant - Internet of Things Engineering and Telecommunications. Our special gratitude for managing the whole process go to Dr. Jacek Cichocki, Dr. Andrzej Buchowicz and Prof. Waldemar Smolik.

We are very proud of our staff. The 2020 will be remembered as the Year of Prof. Krzysztof Zaremba election for the new Rector of the University. I believe it will be a very successful term – good luck! The past year was also a successful for the young crew - 6 PhD Theses have been defended, 3 of them with honors. This Year was also full of awards, granted to our staff. The most prominent are Knight's Cross of the Order of Polonia Restituta for Prof. Wojciech Gwarek and Prof. Krzysztof Zaremba. Another important distinction was recognizing Prof. Roman Morawski as the most published Polish author by the IEEE Transactions on Instrumentation and Measurement. Dr Grzegorz Bogdan won the 1st prize in the nationwide contest of the Foundation for the Development of Radiocommunications and Multimedia Technologies for the Best Ph.D. Thesis.

In 2020, after long preparations and signing agreements between the University and Huawei corporation, the Institute was able to initiate the Artificial Intelligence laboratory. The laboratory consists of servers for deep learning and the set of embedded computers for image analysis. Currently, the hardware is prepared for the didactic and research activities (including special courses for WUT students and MBA studies). Thanks to the support from Huawei, we can launch multiple endeavors, especially related with the Internet of Things field.

The new organizational structure of the institute, introduced in 2019, is now operating at full speed. The new divisions (i.e. Division of Multimedia Engineering, Division of Radiocommunication and Radiolocation, and Division of Subterahertz Technique) have already established their positions in our landscape. We hope to see more outstanding achievements on their side in the future.

Sadly, in 2020 we also bid farewell to one of our iconic professors, Stefan Hahn. Retired for a long time, he was still a part of the Institute's life, visiting us, still doing research. He died shortly after turning 99.

To sum up, although the pandemic has significantly changed our work regime and the University suffered from the changing situation in its surrounding environment, we remain optimistic and look into the future with high hopes, expecting the incoming Year of 2021 to be fruitful and successful for all of us.

Professor Józef Modelska

Warsaw, January 2021

Classification of publications presented in this Report
is in accordance with the rules in force in 2020

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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-

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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

Józef Modelska, Prof. D.Sc., Full Professor
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Secretariat

Anna Tratkiewicz, Senior Administrative Clerk (0.6 till Jul. 2020)
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Anna Smenda, Administrative Clerk
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Deputy Director for Research

Piotr Bilski, D.Sc., Associate Professor
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Secretariat

Anna Noińska, Administrative Clerk for Research (0.8)
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Deputy Director for Academic Affairs

Jacek Cichocki, Ph.D., Reader (till Aug. 2020)
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Andrzej Buchowicz, Ph.D. Assistant Professor (from Sept. 2020)
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Secretariat

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Director's Representative for Economy & Administration

Piotr Brzeski, Ph.D., Didactic Assistant Professor (0.5)
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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;
- Nuclear and Medical Electronics Division;
- Radiocommunications and Radiolocation Engineering Division;
- Subterahertz Technology Division;
- Multimedia Engineering Division.

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

1.3.1. Electroacoustics Division

Head of Division

Jan Żera, Prof. D.Sc., Full Professor
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Senior academic staff

Piotr Bilski, D.Sc., Associate Professor
Piotr Bobiński, Ph.D., Assistant Professor
Marcin Lewandowski, Ph.D., Assistant Professor
Robert Łukaszewski, Ph.D., Assistant Professor
Grzegorz Makarewicz, Ph.D., Assistant Professor (0.5)
Krzysztof Mroczek, Ph.D., Assistant Professor

Junior academic staff

Maciej Jasiński, M.Sc., Assistant (0.5 from Feb. 2020)
Agnieszka Pietrzak, M.Sc., Assistant

Technical staff

Grzegorz Makarewicz, Ph.D., Research Support Engineer (0.5)

Ph.D. Students

Krzysztof Dowalla, M.Sc., from Feb. 2017
Salomea Grodzicka, M.Sc., from Oct. 2019
Maciej Jasiński, M.Sc., from Feb. 2018
Jacek Majer, M.Sc., from Oct. 2018
Tomasz Markowski, M.Sc., from Feb. 2018
Bartosz Polok, M.Sc., from Oct. 2015
Agnieszka Pietrzak, M.Sc., from Feb. 2015
Jakub Tkaczuk, M.Sc., from Oct. 2020
Augustyn Wójcik, M.Sc., from Oct. 2015
Katarzyna Wynimko, M.Sc., from Oct. 2018
Bartosz Źłobiński, 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.

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

- modern information technologies, e.g. LabVIEW, Java, XML, and modern communication technologies, e.g. the Internet, GSM, Bluetooth, ZigBee in distributed control and measuring systems;
- virtual instrumentation, plug-in boards for data acquisition, IEEE-488 equipment;
- artificial intelligence methods in diagnostics of analog systems;
- non-invasive methods for monitoring and analysis of electricity consumption around the end users.

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

1.3.2. Nuclear and Medical Electronics Division

Head of Division

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

Krzysztof Zaremba, Prof. D.Sc., Full Professor
Piotr Bogorodzki, D.Sc., Associate Professor
Waldemar Smolik, D.Sc., Associate Professor
Grzegorz Domański, Ph.D., Assistant Professor
Bogumił Konarzewski, Ph.D., Assistant Professor
Jacek Kryszyn, Ph.D., Assistant Professor
Robert Kurjata, Ph.D., Assistant Professor
Ewa Piątkowska-Janko, Ph.D., Assistant Professor
Dariusz Radomski, Ph.D., Research Assistant Professor
Tymon Rubel, Ph.D., Assistant Professor
Andrzej Rychter, Ph.D., Assistant Professor
Marcin Ziembicki, Ph.D., Assistant Professor (from Aug. 2020)
Piotr Brzeski, Ph.D., Senior Lecturer (0.5 till Sept. 2020, Didactic Assistant Professor 0.5 from Oct. 2020)
Tomasz Olszewski, M.Sc., Senior Lecturer (till Sept. 2020, Didactic Assistant, 0.5 from Oct. 2020)

Junior academic staff

Wojciech Obrebski, M.Sc., Assistant (0.5)
Michał Wieteska, M.Sc., Assistant (0.5 from Mar. 2020)
Przemysław Wróblewski, M.Sc., Assistant

Technical staff

Marcin Krzewski, M.Sc., R&D Engineer (till Nov. 2020)
Tomasz Olszewski, M.Sc., R&D Eng. (0.5 from Oct. 2020)
Bartłomiej Radzik, M.Sc., R&D Engineer (till Nov. 2020)
Mateusz Stosio, M.Sc., R&D Engineer (till Nov. 2020)
Damian Wanta, M.Sc., R&D Engineer (till Nov. 2020)
Andrzej Wasilewski, Worker

Ph.D. students

Monika Drabik, M.Sc. from Oct. 2016
Adam Klekotko, M.Sc. from Feb. 2020
Bartosz Kossowski, M.Sc., from Oct. 2013
Kamil Lipiński, M.Sc., from Oct. 2019
Mateusz Midura, M.Sc., from Oct. 2019
Katarzyna Orzechowska, M.Sc., from Oct. 2019
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

Agata Zakrzewska, M.Sc., from Oct. 2019

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.

1.3.3. Radiocommunications and Radiolocation Engineering Division

Head of Division

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Senior academic staff

Józef Modelska, Prof. D.Sc., Full Professor
Wojciech Wojtasik, D.Sc., Associate Professor
Jacek Cichocki, Ph.D., Reader
Daniel Gryglewski, Ph.D., Assistant Professor
Wojciech Kazubski, Ph.D., Assistant Professor
Jerzy Kołakowski, Ph.D., Assistant Professor
Przemysław Korpas, Ph.D., Assistant Professor
Sebastian Kozłowski, Ph.D., Assistant Professor
Krzysztof Kurek, Ph.D., Assistant Professor
Mirosław Mikołajewski, Ph.D., Assistant Professor
Dawid Rosołowski, Ph.D., Assistant Professor
Przemysław Miazga, Ph.D. Senior Lecturer

Junior academic staff

Vitomir Djaja-Joško, M.Sc., Assistant
Marcin Kołkowski, M.Sc., Assistant (0.5 from May 2020)

Technical staff

Mirosław Lubiejewski, Foreman

Ph.D. students

Vitomir Djaja-Joško, M.Sc., from Oct. 2015
Marcin Kołkowski, M.Sc., from Oct. 2016
Tomasz A. Miś, M.Sc., from Oct. 2017
Jakub Sobolewski, M.Sc., from Feb. 2017
Maciej Soszka, M.Sc., from Oct. 2018

Temporary Staff

Dariusz Kołodziej, M.Sc., Support Enginner (0.5)

Retired

Jan Ebert, Prof. D.Sc.,
Wojciech Gwarek, Prof. D.Sc.,

Stefan Hahn, Prof. D.Sc.,

Stanisław Rosłoniec, Prof. D.Sc.

Waldemar Kiełek, D.Sc.,

Tomasz Kosiło, Ph.D.,

Tadeusz Morawski, Prof. D.Sc.,

Karol Radecki, Ph.D.

Henryk Chaciński, M.Sc.

The Radiocommunications and Radiolocation Engineering Division conducts scientific and applied research around microwave theory and techniques, radio communication systems and networks, radar systems, and measurement techniques in the field of microwaves and millimeter waves. This includes the subjects of computer-aided design and signal processing. Specific research topics included:

- radiocommunication systems and networks – cellular networks, satellite systems and broadband access networks, and propagation channel analysis and modeling,
- Internet of Things technology and applications – methodologies for the antenna design and embed-

ded software for the Single Board Computer-based systems,

- UWB – wireless ultra-wideband systems – methods and systems for communication and localization,
- re-configurable and software-defined radio systems,
- design of front-ends for wireless systems with power amplifiers linearized using signal processing such as digital pre-distortion techniques,
- design of transmitter/receiver modules for radar applications,
- development of high-power high-frequency stability sources for microwave heating,
- methods of synthesis and computer-aided design of passive and active microwave circuits and devices (couplers, power combiners and dividers, switches, transistor circuits, oscillators, synthesizers, modulators, amplifiers) and microwave semiconductor device modelling,
- design of accurate Q-Factor determination equipment applicable in material characterization using resonant techniques,
- development of 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, and high-efficiency AC-DC and DC-DC converters.

1.3.4. Subterahertz Technology Division

Head of Division

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Senior academic staff

Yevhen Yashchyshyn, Prof. D.Sc., Full Professor
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Bartłomiej Salski, D.Sc., Associate Professor
Paweł Bajurko, Ph.D., Assistant Professor
Grzegorz Bogdan, Ph.D., Assistant Professor
Krzysztof Derzakowski, Ph.D., Assistant Professor
Konrad Godziszewski, Ph.D., Assistant Professor
Maciej Sypniewski, Ph.D., Senior Lecturer (0.5)

Junior academic staff

Tomasz Karpisz, Ph.D., Assistant
Mateusz Krysicki, M.Sc., Research Assistant

Ph.D. students

Jerzy Cuper, M.Sc., from Oct. 2019
Mateusz Krysicki, M.Sc., from Oct. 2014
Adam Pacewicz, M.Sc., from Oct. 2017
Adam Raniszewski, M.Sc., from Feb. 2015

Temporary Staff

Marcin Karpisz, B.Sc., R&D Engineer (0.5 from Feb. 2020)

The most important research topics of the Division include analysis, development and investigation of:

- sub-terahertz technology;
- antenna measurements;
- antenna design and fabrication;
- accurate, repeatable measurements on-wafer up to 500 GHz;

This includes of measurements in the wide frequency range thanks to a unique set consisted of four-port PNA-X

Vector Network Analyzers from Agilent Technologies and six pairs of Frequency Extenders for measurements up to 500 GHz. Each pair of Frequency Extenders is designed for single band of standard rectangular waveguide and allows to measure full two-port scattering matrix (amplitude and phase) with a very high dynamic range (above 100 dB). The wide frequency range and large number of measurement points (up to 32001 points) enables further processing of the measured data in the time domain. This set is used for measurements of antenna parameters, and is a part of the quasi-optical setup for the characterization of materials in the millimeter-wave and sub-terahertz ranges.

The research and teaching activities are also performed at the Antenna and Sub-terahertz Technology laboratory. The laboratory was partly funded by European Development Fund (ERDF) in scope of Operational Programme Innovative Economy (POIG) as a part of the Faculty Research Centre FOTEH (Photonics and Terahertz Technologies). The Antenna Laboratory enables research on spatial distributions of the electromagnetic field up to sub-terahertz range to develop and study of antennas, characterization of materials and designing of communication, imaging and radar systems.

The research topics of the Laboratory of Field Methods in the Microwave and Sub-Terahertz Techniques include characterization of low-loss dielectric materials and conductive materials in the range 1–110 GHz by various resonance methods, including the use of a Fabry-Perot open resonator, and ferromagnetic materials in the range 1–30 GHz by resonance methods, electromagnetic modeling of problems related to microwave heating, propagation of electromagnetic waves in the atmosphere, electromagnetic modeling and measurements of the effective reflection surface of absorption panels, designing frequency synthesizers operating in the microwave and millimeter bands, and frequency multipliers operating in the microwave and millimeter bands.

1.3.5. Multimedia Engineering Division

Head of Division

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Senior academic staff

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Włodzisław Skarbek, Prof. D.Sc, Full Professor (0.75 from Sept. 2020)

Grzegorz Pastuszak, D.Sc., Associate Professor

Kajetana Snopek, D.Sc., Associate Professor

Andrzej Buchowicz, Ph.D., Assistant Professor

Grzegorz Galiński, Ph.D., Assistant Professor

Paweł Mazurek , Ph.D., Assistant Professor

Andrzej Miękina, Ph.D., Assistant Professor

Jakub Wagner, Ph.D., Assistant Professor (0.5 from Oct. 2020)

Krystian Ignasiak, Ph.D., Senior Lecturer

Junior academic staff

Grzegorz Gwardys, M.Sc. (0.5 from Dec. 2020)

Technical staff

Tomasz Krzymierń, M.Sc., Administrative Clerk for Health and Safety

Ph.D. students

Xin Chang, M.Sc., from Oct. 2018
Michał Daniluk, M.Sc., from Oct. 2020
Daniel Mostowski, M.Sc., from Oct. 2020
Zbigniew Nasarzewski, M.Sc., from Feb. 2017
Rafał Pilarczyk, M.Sc., from Oct. 2017
Rafał Protasiuk, M.Sc., from Oct. 2016
Mikołaj Wieczorek, M.Sc., from Oct. 2020

Retired

Marek Rusin, Ph.D.

Scientific and teaching activities of the Division cover most of the modern television aspects, beginning with the basics to the leading and fastest developing areas: digital image processing in multimedia, high resolution TV (HDTV), cable TV (CATV), industrial television. Besides basic television courses, the division teaches microcontrollers, PLD and the selected aspects of the microwaves. Multimedia aspects such as compression, object recognition, hardware technologies (MPEG coders) and software technologies (Java, Python) are gaining recently more attention.

Division consists of 3 groups:

- Deep Neural Network in Digital Media;
- Hardware Algorithms in Digital Media;
- Digital Processing and Measurement Systems.

1.4. Evening Studies and Continuing Education

1.4.1. Postgraduated Studies “Deep Neural Networks – Application in Digital Media”

Head

Włodzisław Skarbek, Prof. D.Sc., Full Professor.

Secretariat

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1.4.2. Engineer Degree Evening Studies on Radiocommunications and Multimedia Technology

Head

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1.5. Other Institute's Units

1.5.1 Accounting Department

Head

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Staff

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Beata Roslon, Accounting Clerk
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1.5.2 Supply Section

Staff

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Andrzej Owczarek, M.Sc., Maintenance Engineer (0.5)
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1.5.3 Office of the Foundation for the Development of Radiocommunication and Multimedia Technology

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2. STAFF

2.1. Senior academic staff

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M.Sc. ('04), Ph.D. ('12); antennas and antenna arrays; reconfigurable systems, sub-THz techniques, wireless localization; **Assistant Professor**, Sub-Terahertz Technology Division;
[Edu99]; [Pro3], [Pro40], [Pro41], [Pro42], [Pro43], [Pro44], [Pro45], [Pro49], [Pro51]; [Pub20], [Pub48], [Pub49], [Pub65], [Pub66], [Pub67].

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M.Sc. ('01), Ph.D. ('06), D.Sc. ('14); measurement systems, virtual instrumentation, digital signal processing, diagnostics of analog systems, artificial intelligence; **Associate Professor**, Electroacoustics Division.

Deputy Director for Research of the Institute of Radioelectronics and Multimedia Technology ('19-); Member of IEEE ('05-), POLSPAR Board ('14-), and IMEKO TC10 Board ('12-). Member of the Control Committee of the iUSER Sector Program, National Centre for the Research and Development ('16-); Member of the Scientific Council for Automatic Control, Electronics, and Electrical Engineering, WUT ('19-); Member of the Editorial Board of *International Journal of Computing* ('19-);
[Edu19], [Edu63]; [Pro19]; [MSc3], [MSc8], [MSc13], [MSc36], [MSc42]; [BSc34], [BSc65]; [Pub16], [Pub31], [Pub35], [Pub89], [Pub107], [Pub127], [Pub128].

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M.Sc. ('98), Ph.D. ('04); acoustics, electroacoustics and sound engineering, digital audio signal processing, multimedia and measurement systems, distributed systems and web technology; **Assistant Professor**, Electroacoustics Division;
[Edu3], [Edu99], [Edu101]; [MSc25]; [BSc2], [BSc7], [BSc23], [BSc52]; [Pub31].

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M.Sc. ('13), Ph.D. ('19); telecommunications; **Assistant Professor**, Sub-Terahertz Technology Division.
[Edu24]; [Pro24], [Pro25], [Pro38], [Pro45]; [Pub17], [Pub18], [Pub19], [Pub20], [Pub21], [Pub55], [Pub67], [Pub68], [Pub123]; [Pat1], [Pat2].

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[Edu73], [Edu98], [Edu100]; [Pro18], [Pro35]; [MSc1]; [BSc58]; [Pub1], [Pub23], [Pub24], [Pub130].

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[Edu4], [Edu5], [Edu13], [Edu20], [Edu81], [Edu98], [Edu100]; [Pro34].

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[Edu8], [Edu55], [Edu93], [Edu99], [Edu101]; [Pro1], [Pro27]; [MSc17]; [BSc46], [BSc63]; [Pub108].

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[Edu10], [Edu17], [Edu39], [Edu44], [Edu94], [Edu99]; [Pro7], [Pro9], [Pro11]; [MSc24], [MSc41]; [BSc22]; [Pub27].

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[Edu6], [Edu27].

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[Edu31], [Edu46], [Edu98], [Edu100]; [MSc9], [MSc10], [MSc19], [MSc26], [MSc31], [MSc33]; [BSc13], [BSc14], [BSc39].

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[Edu12], [Edu64], [Edu99]; [Pro1], [Pro27]; [MSc2]; [BSc20], [BSc50], [BSc62].

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[Edu43], [Edu45], [Edu99], [Edu101]; [Pro45], [Pro50]; [MSc4]; [BSc64]; [Pub15], [Pub17], [Pub18], [Pub19], [Pub21], [Pub54], [Pub63], [Pub65], [Pub66], [Pub67], [Pub77], [Pub119].

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[Edu11], [Edu51]; [Pro4], [Pro12], [Pro15], [Pro37]; [MSc39]; [Pub34], [Pub79], [Pub80].

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[Edu7], [Edu9], [Edu23], [Edu38], [Edu41], [Edu99], [Edu101]; [BSc1], [BSc51], [BSc54], [BSc67].

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Golden Medal for the Long-lasting Service ('20).
[Edu43], [Edu99]; [Pro45]; [BSc68]; [Pub93].

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[Edu17], [Edu57], [Edu84]; [Pro7], [Pro9], [Pro11]; [MSc11], [MSc20]; [Pub26], [Pub27], [Pub29], [Pub71], [Pub82].

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[Edu1], [Edu47], [Edu98], [Edu100]; [BSc30], [BSc48].

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[Edu69]; [Pro4], [Pro10], [Pro13], [Pro14], [Pro17], [Pro20], [Pro22], [Pro26]; [Pub32], [Pub33], [Pub42], [Pub45], [Pub46], [Pub72], [Pub73], [Pub81], [Pub86], [Pub105], [Pub113], [Pub114].

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[Edu40], [Edu54], [Edu62], [Edu99], [Edu101]; [Pro12], [Pro15]; [MSc7]; [BSc36], [BSc43]; [Pub69], [Pub112].

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[Edu32], [Edu71], [Edu80], [Edu99], [Edu101]; [Pro40]; [MSc37].

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[Edu98], [Edu100]; [Pro30], [Pro34], [Pro39], [Pro46]; [BSc8], [BSc41].

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[Edu10], [Edu48], [Edu82].

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[Edu7], [Edu37], [Edu52], [Edu75], [Edu83], [Edu98],
[Edu100]; [Pro1], [Pro5], [Pro6], [Pro27]; [MSc12];
[BSc3], [BSc24], [BSc44], [BSc66]; [Pub3], [Pub4],
[Pub5], [Pub6], [Pub7], [Pub8], [Pub9], [Pub10],
[Pub11], [Pub12], [Pub13], [Pub14].

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[Edu53], [Edu66], [Edu99]; [BSc40], [BSc59].

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[Edu99], [Edu101]; [Pub76], [Pub121].

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[Edu15]; [BSc10], [BSc53]; [Pub89].

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[Edu16], [Edu42], [Edu67], [Edu68], [Edu79], [Edu98],
[Edu100]; [Pro6], [Pro27]; [PhD6]; [Pub11], [Pub12],
[Pub13].

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[Edu25], [Edu35], [Edu77]; [Pro23]; [BSc12]; [Pub36],
[Pub91].

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[Edu18], [Edu24], [Edu70].

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[Edu35], [Edu36], [Edu99]; [Pub36].

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M.Sc. ('87), Ph.D. ('93); radio-frequency engineering, power electronics, radio transmitters, switch-mode power supplies; **Assistant Professor**, Radiocommunications and Radiolocation Division.

[Edu21]; [Pub38], [Pub92], [Pub93].

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M.Sc. ('73), Ph.D. ('78), D.Sc. ('87), Prof. Title ('94), Honoris Causa Doctorates from: Military University of Technology ('11), and the Lodz University of Technology ('14); radio-frequency engineering, microwave techniques; **Full Professor**, Director of the Institute of Radioelectronics and Multimedia Technology ('96-16, '19-).

Full Member of the Polish Academy of Sciences ('19); President of URSI National Committee ('12-); Corresponding Member of the Polish Academy of Sciences – PAN ('07-); Member of the National Committee for Co-operation with the Inter. Council of Science ('12-), Member of the Com. on Electronics and Telecommunications PAN ('07-); Member of the Committee on Space and Satellite Research PAN ('01-); Associated Member of the Ukrainian National Academy of Sciences ('99-); Member of Scientific Councils: Military Communication Institute ('10-), Space Research Centre PAN ('11-); Chairman of the MIKON Foundation Council ('15-); President of the Foundation for the Development of Radiocommunications and Multimedia Technology ('00-); Member of Editorial Board of *IEEE Transactions on MTT* ('95-); Chairman of the Microwave and Radar Week ('04-); TPC Member of the IEEE MTT-S International Microwave Symposium ('95- and European Microwave Conference ('01-); Chair of the Programme Council of the International Conference the Polish Chamber for Electronic Communication ('05-); Golden Graduates' Book of WUT ('15); Chair of the Faculty Council Committee on Awards ('16-), Polish Congress Ambassador ('17); Honorary Citizen of Golina city in the Wielkopolskie Voivodship ('18), Member of the Polish Space Agency Board ('20-).

[Edu67], [Edu68], [Edu99], [Edu101]; [Pub40].

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Chair of the Faculty Council Committee on Academic Staff Development ('16-); Member of the Working Group for implementation at WUT of the principles of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers ('18-), Member of the Jury of the WUT Medal for Young Scientist ('08-); Recipient of individual awards of the Rector ('20).
[Edu25], [Edu35], [Edu36], [Edu77], [Edu98], [Edu99], [Edu100]; [PhD5]; [Pub36], [Pub37].

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[Pro1], [Pro27]; [BSc60]; [Pub43], [Pub44], [Pub108].

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[Edu98], [Edu100]; [Pro18], [Pro35]; [BSc6]; [Pub1], [Pub130].

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[Edu98], [Edu100]; [Pro29].

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[Edu30], [Edu99], [Edu101]; [Pro8], [Pro12], [Pro15], [Pro16], [Pro33]; [BSc37]; [Pub111], [Pub112].

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[Edu14], [Edu98], [Edu100]; [MSc14], [MSc16], [MSc27], [MSc32]; [BSc31]; [Pub50], [Pub131].

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[Edu29], [Edu98]; [Pro1], [Pro5], [Pro6], [Pro27], [Pro39], [Pro46]; [MSc5], [MSc44]; [BSc5], [BSc33]; [Pub3], [Pub4], [Pub5], [Pub6], [Pub7], [Pub8], [Pub9], [Pub10], [Pub11], [Pub12], [Pub13], [Pub14].

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[Edu26], [Edu40]; [Pro10], [Pro13], [Pro14], [Pro17], [Pro20], [Pro21], [Pro26], [Pro28]; [PhD2]; [Pub32], [Pub33], [Pub42], [Pub45], [Pub46], [Pub72], [Pub73], [Pub81], [Pub85], [Pub86], [Pub87], [Pub105], [Pub113], [Pub114].

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[Edu58], [Edu74], [Edu89], [Edu99], [Edu101]; [MSc22]; [Pub70].

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M.Sc. ('91), Ph.D. ('97), D.Sc. ('14); computer engineering, biomedical engineering, computer tomography; **Associate Professor**, Nuclear and Medical Electronics Division.

Member of the Faculty Council Committee on Education ('16-); Member of the Scientific Council for Biomedical Engineering, WUT ('19-); Member of the Steering Committee - *Intelligent Decision Support System based on the Algorithmic Image Analysis in the Operations of the Justice System - BIO10* Programme.
[Edu60], [Edu98], [Edu100]; [Pro19], [Pro34], [Pro39], [Pro46]; [MSc21], [MSc30], [MSc43]; [BSc49], [BSc57].

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M.Sc. ('91), Ph.D. ('02), D.Sc. ('14); signal and system theory and applications; **Associate Professor**, Multimedia Engineering Division.

Head of the Multimedia Engineering Division ('20-); Head of the "WUT Eagle School" Project at the Faculty of Electronics and Information Technology (POWER Program) ('19-); Secretary of the Board of the Foundation for the Development of Radiocommunications and Multimedia Technology ('16-); Member of the Scientific Council for Automatic Control, and Electrical Engineering, WUT ('19-); Member of the Programme Committee of *4th International Conference on Telecommunications and Signal Processing* (2020); Member of the Technical Program Committee AICT 2020, *The Sixteenth Advanced International Conference on Telecommunications* (2020), Member of the Steering Committee - *Intelligent Decision Support System based on the Algorithmic Image Analysis in the Operations of the Justice System* - BIO10 Programme.
[Edu20], [Edu49], [Edu50], [Edu98], [Edu100]; [Pro19]; [BSc9]; [Pub2], [Pub64], [Pub126].

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M.Sc. ('83), Ph.D. ('96); microwave technique; **Senior Lecturer**, Sub-Terahertz Technology Division.
[Edu40]; [BSc18], [BSc32], [BSc45].

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M.Sc. ('11), Ph.D. ('20); measurement and instrumentation, **Assistant Professor**, Multimedia Engineering Division
[PhD5].

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M.Sc. ('84), Ph.D. ('98), D.Sc. ('15); microwave technique; **Associate Professor**, Radiocommunications and Radiolocation Division, Head of Division ('20-). Member of IEEE ('96-); Member of the Scientific Council for Automatic Control, Electronics and Electrical Engineering, WUT ('19-).
[Edu20], [Edu30], [Edu99], [Edu101]; [Pro4], [Pro12], [Pro15], [Pro36]; [PhD1], [PhD3]; [Pub34], [Pub79], [Pub80].

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M.Sc. ('79), Ph.D. ('86), D.Sc. ('06), Prof. Title ('16); telecommunications; **Full Professor**, Sub-Terahertz Technology Division.

Head of Division ('20-). 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-); Member of the Scientific Council Automatic Control, Electronics, and Electrical Engineering, WUT ('19-).

[Edu2], [Edu59], [Edu99]; [Pro2], [Pro3], [Pro50]; [PhD4]; [MSc6]; [BSc15]; [Pub17], [Pub18], [Pub19], [Pub20], [Pub21], [Pub25], [Pub41], [Pub47], [Pub51], [Pub52], [Pub53], [Pub55], [Pub65], [Pub66], [Pub68], [Pub77], [Pub115], [Pub119], [Pub122], [Pub123]; [Pat1], [Pat2].

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M.Sc. ('81), Ph.D. ('90), D.Sc. ('03), Prof. Title ('12), biomedical engineering, nuclear electronics; **Full Professor**, Rector of the WUT ('20-); Dean of the Faculty ('12-'20); Nuclear and Medical Electronics Division.

Member of CERN ('89-); Member ('05-) and Chairman ('16-) 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-), 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-'20); 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-); Member of the Scientific Council for Automatic Control, Electronics and Electrical Engineering, WUT ('19-); Recipient of an individual award of the Rector ('20); Head of the Committee on Education, the Conference of Rectors of Academic Schools in Poland, ('20-), Knight's Cross of the Order of Polonia Restituta ('20).

[Edu67], [Edu68], [Edu98], [Edu100]; [Pro5], [Pro6], [Pro27]; [Pub3], [Pub4], [Pub5], [Pub6], [Pub7], [Pub8], [Pub9], [Pub10], [Pub11], [Pub12], [Pub13].

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M.Sc. ('02), Ph.D. ('20); nuclear and medical electronics; **Assistant Professor**, Nuclear and Medical Electronics Division.

[Pro1], [Pro5], [Pro6], [Pro27]; [PhD6]; [BSc29], [BSc35]; [Pub3], [Pub4], [Pub5], [Pub6], [Pub7], [Pub8], [Pub9], [Pub10], [Pub11], [Pub12], [Pub13], [Pub14].

Jan Żera

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M.Sc. ('76), Ph.D. ('90), D.Sc. ('04); acoustics, Prof. Title ('17); electroacoustics, psychoacoustics, noise control; **Full 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-); Member of the Scientific Council for Automatic Control, Electronics, and Electrical Engineering, WUT ('19-).
[Edu33], [Edu72], [Edu99], [Edu101]; [Pro47], [Pro48].

2.2. Junior academic staff

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Maciej Jasiński, M.Sc., Assistant (from Feb. 2020)
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2.3. Ph.D. students (the third-level studies)

Ph.D. Student (tutor)

Xin Chang, M.Sc. (W. Skarbek)
Michał Daniłuk, M.Sc. (W. Skarbek)
Vitomir Djaja-Jośko, M.Sc. (J. Modelska)
Krzysztof Dowalla, M.Sc. (P. Bilski)
Monika Drabik, M.Sc. (P. Bogorodzki)
Salomea Grodzicka, M.Sc. (P. Bilski)
Maciej Jasiński, M.Sc. (J. Żera)
Adam Klekotko, M.Sc. (J. Marzec)
Marcin Kołakowski, M.Sc. (J. Modelska)
Kamil Lipiński, M.Sc. (P. Bogorodzki)
Jacek Majer, M.Sc.* (J. Żera)
Tomasz Markowski, M. Sc.* (P. Bilski)
Mateusz Midura, M.Sc. (W. Smolik)
Tomasz A. Miś, M.Sc. (J. Modelska)
Daniel Mostowski, M.Sc. (W. Skarbek)
Zbigniew Nasarzewski, M.Sc.* (W. Skarbek)
Katarzyna Orzechowska, M.Sc. (K. Zaremba)
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. Wojtasik)
Jakub Sobolewski, M.Sc. (Y. Yashchyshyn)
Maciej Soszka, M.Sc. (Y. Yashchyshyn)
Mateusz Stosio, M.Sc.* (W. Smolik)
Jakub Tkaczuk, M.Sc. (P. Bilski)

Damian Wanta, M.Sc. (W. Smolik)
Mikołaj Wieczorek, M.Sc. (W. Skarbek)
Michał Wieteska, M.Sc. (P. Bogorodzki)
Arkadiusz Wójcik, M.Sc. (J. Modelska)
Augustyn Wójcik, M.Sc. (P. Bilski)
Przemysław Wróblewski, M.Sc.* (W. Smolik)
Katarzyna Wynimko, M.Sc. (J. Żera)
Agata Zakrzewska, M.Sc. (W. Smolik)
Bartosz Żłobiński, M.Sc. (J. Żera)

* without scholarship

2.4. Technical and administrative staff

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Anna Noińska, Admin. Clerk for Research (0.8)
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Janina Nowak, Senior Accounting Clerk (till Oct. 2020)
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Tomasz Olszewski, M.Sc., R&D Eng. (0.5)
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Andrzej Owczarek, M.Sc., Maintenance Engineer (0.5)
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Beata Rosłon, Accounting Clerk
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STAFF

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Anna Smenda, Administrative Clerk

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Mateusz Stosio, M.Sc., R&D Engineer*** till

Nov. 2020)

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Anna Tratkiewicz, Senior Administrative Clerk (0.6, till Jul. 2020)

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Andrzej Wasilewski, Worker

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Damian Wanta, M.Sc., R&D Engineer*** till Nov. 2020)

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e-mail: D.Wanta@ire.pw.edu.pl

temporary research staff for the projects: *TEAM-TECH, **WidePOWER ***PRO-WM

3. TEACHING ACTIVITIES

(the summer semester of the academic year 2019/2020 and the winter semester of the academic year 2020/2021)

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., Full Professor (till Sept. 2020)
room: 72, phone: +48 22 2347955, +48 22 2347497
e-mail: K.Zaremba@ire.pw.edu.pl

3. Biomedical Engineering

Head

Waldemar Smolik, D.Sc., Associate Professor (till Nov. 2020)
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e-mail: W.Smolik@ire.pw.edu.pl

3.1.1. Basic courses

- [Edu1] *Analysis of Measurement Data in Medicine* (Analiza danych pomiarowych w medycynie – ADP); 45 h/sem.; B. Konarzewski.
- [Edu2] *Antennae (Anteny – ANT)*; 45 h/sem.; Y. Yashchyshyn.
- [Edu3] *Basics of Sound Techniques* (Podstawy techniki dźwiękowej – PTD); 60 h/sem.; P. Bobiński.
- [Edu4] *Basics of Medical Imaging* (Podstawy obrazowania medycznego – POMED); 45 h/sem.; P. Brzeski.
- [Edu5] *Basics of Medical Imaging Techniques* (Podstawy technik obrazowania w medycynie – PTOM); 60 h/sem.; P. Brzeski.
- [Edu6] *Basics of Microprocessor Technique* (Podstawy techniki mikroprocesorowej – TMIK); 60 h/sem.; K. Derzakowski.
- [Edu7] *Basics of Programming* (Podstawy programowania – PPR); 60 h/sem.; K. Ignasiak, R. Kurjata.
- [Edu8] *Basics of Programming 1* (Podstawy programowania – PRM1T); 60 h/sem.; A. Buchowicz.
- [Edu9] *Basics of Programming 2* (Podstawy programowania – PRM2T); 55 h/sem.; K. Ignasiak.
- [Edu10] *Basics of Radiocommunications* (Podstawy radiokomunikacji – PR); 45 h/sem.; J. Cichocki, K. Kurek.
- [Edu11] *Basics of Radiolocation and Radionaviga-*

tion (Podstawy radiolokacji i radionawigacji – PRIR); 45 h/sem.; D. Gryglewski

- [Edu12] *Basics of Image Techniques* (Podstawy techniki obrazowej – PTO); 45 h/sem.; G. Galiński.
- [Edu13] *Biomedical Accelerators* (Akceleratory biomedyczne – ABM); 30 h/sem.; P. Brzeski, S. Wronka.
- [Edu14] *Computer Graphics* (Grafika komputerowa – GRK); 30 h/sem.; T. Rubel.
- [Edu15] *Construction of High Quality Audio Equipment* (Konstrukcja urządzeń audio wysokiej jakości – KUA); 30 h/sem.; G. Makarewicz.
- [Edu16] *Detection of Nuclear and Biomedical Signals* (Detekcja sygnałów biomedycznych i jądrowych – DSBJ); 60 h/sem.; J. Marzec.
- [Edu17] *Digital Cellular Systems* (Cyfrowe systemy komórkowe – CSK); 45 h/sem.; J. Cichocki, J. Kołakowski.
- [Edu18] *Digital Circuits – EDC1*; 60 h/sem.; P. Miazga (English-medium studies).
- [Edu19] *Digital Communications – EDICO*; 60 h/sem.; P. Bilski (English-medium studies).
- [Edu20] *Diploma Seminar for Undergraduate Students* (Seminarium dyplomowe inżynierskie – SDI); 30 h/sem.; P. Brzeski, K. Snopek, W. Wojtasik.
- [Edu21] *DC/DC Power Converters Supply* (Zasilanie układów elektronicznych - ZUE); 45 h/sem.; M. Mikołajewski.
- [Edu22] *Electronic Circuits* (Układy elektroniczne – UEL); 60 h/sem.; W. Obrębski.
- [Edu23] *Event-Driven Programming* (Programowanie zdarzeniowe – PROZE); 45 h/sem.; K. Ignasiak.
- [Edu24] *Evolutionary Algorithms* (Algorytmy ewolucyjne – AE); 45 h/sem.; G. Bogdan, 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 żywego – OFE); 30 h/sem.; K. Derzakowski.
- [Edu28] *Introduction to Medical Science* (Wprowadzenie do nauk medycznych – WNM); 45 h/sem.; K. Szopiński.
- [Edu29] *Medical Electronic Instrumentation* (Elektroniczna aparatura medyczna – EAME);

TEACHING ACTIVITIES

	60 h/sem.; A. Rychter.	[Edu49] <i>Signals and Systems</i> (Sygnały i systemy – SYGSY); 60 h/sem.; K. Snopk.
[Edu30]	<i>Microwave Technique</i> (Technika mikrofalowa – TMO); 45 h/sem.; D. Rosołowski, W. Wojtasiak.	[Edu50] <i>Signals, Modulations and Systems</i> (Sygnały, modulacje i systemy – SYMSE); 45 h/sem.; K. Snopk.
[Edu31]	<i>Microprocessor Technique</i> (Technika mikroprocesorowa – TEMI); 45 h/sem.; G. Domański.	[Edu51] <i>Simulations of Radioelectronics Circuits</i> (Symulacja układów radioelektronicznych – SUREL); 45 h/sem.; D. Gryglewski.
[Edu32]	<i>Multi-service and Multimedia Networks – EMSMN</i> ; 60 h/sem.; S. Kozłowski (English-medium studies).	[Edu52] <i>Software for Medical Systems</i> (Oprogramowanie systemów medycznych – OSM); 45 h/sem.; R. Kurjata, T. Jamrógiewicz.
[Edu33]	<i>Musical Acoustics</i> (Akustyka muzyczna – AM); 30 h/sem.; J. Żera.	[Edu53] <i>Sound Recording Technique</i> (Dźwiękowa technika studyjna – DTS); 45 h/sem.; M. Lewandowski.
[Edu34]	<i>Nuclear Medicine Techniques</i> (Techniki medycyny nuklearnej – TMENU); 30 h/sem.; R. Szabatin.	[Edu54] <i>Team Project 1</i> (Projekt grupowy 1 – PROJ1); 13 h/sem.; P. Korpas.
[Edu35]	<i>Numerical Methods</i> (Metody numeryczne – MNUB); 45 h/sem.; A. Miękina, P. Mażurek, R. Z. Morawski.	[Edu55] <i>Television Systems</i> (Systemy telewizyjne – SYTE); 45 h/sem.; A. Buchowicz.
[Edu36]	<i>Numerical Methods – ENUME</i> ; 60 h/sem.; R. Z. Morawski, A. Miękina (English-medium studies).	[Edu56] <i>Ultrasonography Instrumentation</i> (Aparatura ultrasonograficzna – AUS); 30 h/sem.; R. Jóźwiak.
[Edu37]	<i>Object-oriented Programming</i> (Programowanie obiektowe – PROBI); 60 h/sem.; R. Kurjata.	[Edu57] <i>UMTS and LTE Systems</i> (Systemy UMTS i LTE – ULTE); 45 h/sem.; J. Kołakowski.
[Edu38]	<i>Object-oriented Programming of Multimedia Applications in Java</i> (Java – obiektowe programowanie aplikacji multimedialnych – OPA); 45 h/sem.; K. Ignasiak.	3.1.2. Advanced courses
[Edu39]	<i>Orientation</i> (Orientacja - ORIT); 8 h/sem. J. Cichocki.	[Edu58] <i>Adaptive Image Recognition</i> – EADIR; 60 h/sem.; W. Skarbek.
[Edu40]	<i>Physics 2 – EPHY2</i> ; 60 h/sem.; B. Salski, P. Korpas, M. Sypniewski (English-medium studies).	[Edu59] <i>Antennae</i> (Anteny – EANTE); 45 h/sem.; Y. Yashchyshyn.
[Edu41]	<i>Programming of Geoinformation Applications</i> (Programowanie aplikacji geoinformacyjnych – PAG); 30 /sem.; K. Ignasiak (for Faculty of Geodesy and Cartography).	[Edu60] <i>Computed Tomography</i> (Tomografia komputerowa – TOM); 60 h/sem.; W. Smolik.
[Edu42]	<i>Radiation Detection</i> (Detekcja promieniowania jonizującego – DEPJO); 30 h/sem.; J. Marzec.	[Edu61] <i>Computer - Aided Medical Image Diagnostics</i> (Komputerowe wspomaganie obrazowej diagnostyki medycznej – KWOD); 45 h/sem.; A. Przelaskowski.
[Edu43]	<i>Radiocommunication Systems</i> (Systemy radiokomunikacyjne – SRKO); 45 h/sem.; K. Godziszewski, W. Kazubski, K. Radecki.	[Edu62] <i>Computational Electromagnetics for Telecommunications</i> – ECOET; 60 h/sem.; P. Korpas (English-medium studies).
[Edu44]	<i>Radioelectronics Measurements</i> (Miernictwo radioelektroniczne – MR); 45 h/sem.; J. Cichocki.	[Edu63] <i>Contemporary Heuristic Techniques</i> (Współczesne techniki heurystyczne – WMH); 60 h/sem.; P. Bilski.
[Edu45]	<i>Radio Networks and Systems</i> (Sieci i systemy radiowe – SISR); 45 h/sem.; K. Godziszewski.	[Edu64] <i>Data Compression</i> (Kompresja danych – KODA); 45 h/sem.; G. Galiński, G. Pasztuszak.
[Edu46]	<i>Radiological Apparatus in Medical Diagnostics</i> (Aparatura radiologiczna w diagnostyce medycznej – ARDM); 30 h/sem.; G. Domański.	[Edu65] <i>Design of Radiocommunication Networks</i> (Projektowanie sieci radiokomunikacyjnych – PSRD); 60 h/sem.; T. Kosilo.
[Edu47]	<i>Radiology and Nucleonics</i> (Radiologia z nukleoniką – RN); 45 h/sem.; B. Konarzewski.	[Edu66] <i>Digital Audio Signal Processing</i> (Cyfrowe przetwarzanie sygnałów fonicznych – CPSF); 45 h/sem.; M. Lewandowski.
[Edu48]	<i>Satellite Communications</i> (Łączność satelitarna – LS); 45 h/sem.; K. Kurek.	[Edu67] <i>Diploma Seminar for Graduate Students 1</i> (Seminarium dyplomowe magisterskie 1 – SDM1); 30 h/sem.; J. Marzec, J. Modelska, K. Zaremba.
		[Edu68] <i>Diploma Seminar for Graduate Students 2</i> (Seminarium dyplomowe magisterskie 2 – SDM2); 30 h/sem.; J. Marzec, J. Modelska, K. Zaremba

TEACHING ACTIVITIES

[Edu69]	<i>Electromagnetic Compatibility</i> (Kompatybilność elektromagnetyczna – KE); 30 h/sem.; P. Kopyt	twarz i sylwetki osoby – M3D), 24 h/sem.; G. Gwardys.
[Edu70]	<i>Evolutionary Algorithms</i> – EEVAL; 60 h/sem.; P. Miazga (English-medium studies).	[Edu87] <i>Deep Networks in the Design of Computer Games - Content and Strategy Aspects</i> (Sieci głębokie w projektowaniu gier komputerowych – aspekty treści i strategii) – SGS); 24 h/sem.; Z. Nasarzewski.
[Edu71]	<i>Graphs and Networks</i> (Grafy i sieci – GIS); 60 h/sem.; S. Kozłowski.	[Edu88] <i>Deep Networks in the Design of Computer Games – Aspects of Player Intelligent Interface</i> (Sieci głębokie w projektowaniu gier komputerowych – aspekty inteligentnego interfejsu gracza – SGI); 24 h/sem.; R. Pilarczyk.
[Edu72]	<i>Hearing and Sound Perception</i> (Słyszenie i percepceja dźwięku – SPD); 45 h/sem.; J. Żera.	[Edu89] <i>Deep Neural Networks-Basics</i> (Głębokie sieci neuronowe – podstawy – GSP); 24 h/sem.; W. Skarbek.
[Edu73]	<i>Magnetic Resonance Imaging</i> (Tomografia rezonansu magnetycznego – TRM); 45 h/sem.; P. Bogorodzki.	[Edu90] <i>Deep Neural Networks Programming</i> (Programowanie głębokich sieci neuronowych – PGS); 24 h/sem.; R. Pilarczyk.
[Edu74]	<i>Mathematics in Multimedia</i> (Matematyka w multimediacach – MATMU); 60 h/sem.; W. Skarbek.	[Edu91] <i>Digital Objects Indexing</i> (Indeksowanie obiektów cyfrowych – IOC); 24 h/sem.; R. Pilarczyk.
[Edu75]	<i>Medical IT Systems</i> (Informatyczne systemy medyczne – ISMED); 45 h/sem.; R. Kurjata.	[Edu92] <i>Digital Objects Recognition</i> (Rozpoznawanie obiektów cyfrowych – ROC); 24 h/sem.; R. Pilarczyk.
[Edu76]	<i>Methodological and Ethical Aspects of Research</i> – EMAR); 45 h/sem.; R. Z. Morawski.	[Edu93] <i>Security in Digital Media</i> (Bezpieczeństwo w mediach cyfrowych – BMC); 12 h/sem.; A. Buchowicz.
[Edu77]	<i>Methodological Aspects of Technoscientific Research</i> – MATR); 30h/sem.; R. Z. Morawski, P. Mazurek.	
[Edu78]	<i>Neural Networks in Biomedical Applications</i> (Sieci neuronowe w zastosowaniach biomedycznych – SNB); 45 h/sem., K. Zaremba.	
[Edu79]	<i>Noise and Electromagnetic Interference in Electronic Devices</i> (Szумy i zakłócenia w aparaturze elektronicznej – SZAЕ); 45 h/sem., J. Marzec.	
[Edu80]	<i>Modern Radio Transmission Techniques</i> (Nowe techniki transmisji radiowej – NTTR); 45h/sem.; S. Kozłowski.	
[Edu81]	<i>Nuclear Medicine Techniques</i> (Techniki medycyny nuklearnej – TMN); 60 h/sem.; P. Brzeski, T. Olszewski, R. Szabatin.	
[Edu82]	<i>Satellite Telecommunications</i> (Telekomunikacja Satelitarna – TSAT); 30 h/sem.; K. Kurek (for Faculty of Power and Aeronautical Engineering).	
[Edu83]	<i>Telemedical Systems</i> (Systemy telemedyczne - TELM); 45 h/sem. R. Kurjata.	
[Edu84]	<i>Ultrawideband Technologies</i> (Techniki ultraszerokopasmowe – TUSP); 45 h/sem.; J. Kołakowski	

3.2. Special courses

3.2.1. Post-graduated studies: “Deep neural networks at digital media”

- [Edu85] *Compression and Immersion of Digital Objects* (Kompresja i zanurzanie obiektów cyfrowych – KZO); 12 h/sem.; R. Protasiuk.
- [Edu86] *3D Modeling – Face and Body Image Analysis* (Modelowanie 3D – analiza obrazu

[Edu94]	<i>Diploma Seminar 2</i> Seminarium dyplomowe – SD2M); 30 h/sem.; semester 8; J. Cichocki.
[Edu95]	<i>Ergonomics and Safety</i> (Ergonomia i bezpieczeństwo pracy – EBPZ); 30 h/sem.; semester 8; L. Kryst.
[Edu96]	<i>Seminar: Knowledge and Information Society</i> (Seminarium: Społeczeństwo wiedzy i informacji – SWM); 30 h/sem.; semester 8; P. Stacewicz.
[Edu97]	Collaboration between the Warsaw University of Technology and the University of Western Australia. Agreement on joint supervision and joint doctoral conferment process. 2020 -2023

The agreement allows to undertake a joint Ph.D. subject to **Jerzy Cuper** M.Sc., candidate from WUT who was registered as a doctoral student at the Doctoral School no. 3. Upon completion of the degree requirements, the candidate will be awarded a single degree issued jointly by both institutions.

3.4. Educational projects

- [Edu98] **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, K. Zaremba, J. Marzec, R. Z. Morawski, P. Bogorodzki, K. Snopek, P. Brzeski, G. Domański, T. Jamrógiewicz, B. Konarzewski, J. Kryszyn, R. Kurjata, E. Piątkowska-Janko, D. Radomski, T. Rubel, A. Rychter, W. Obrebski, P. Wróblewski;

Feb. 01, 2018 – Jan. 01, 2021

Funded by the National Centre for Research and Development EU Operational Programme Knowledge – Education – Development - Cooperation 2014-2021

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.

- [Edu99] **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. Bajurko, P. Bobiński, A. Buchowicz, G. Galiński, K. Godziszewski, K. Ignasiak, W. Kazubski, P. Korpas, S. Kozłowski, K. Kurek, M. Lewandowski, R. Łukaszewski, A. Miękina, J. Modelska, R. Z. Morawski, D. Rosołowski, W. Skarbek, W. Wojtasiak, Y. Yashchyna, J. Źera.

Feb. 01, 2018 – Dec. 01, 2021

EU Operational Programme Knowledge – Education – Development - Cooperation 2014-2021

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.

- [Edu100] **Modification M.Sc. Studies: Biomedical Engineering in the frame of Knowledge – Education – Development - Cooperation Project** (Modyfikacja studiów drugiego stopnia na kierunku „Inżynieria Biomedyczna" w ramach projektu NERW2 PW: Nauka – Edukacja - Rozwój - Współpraca).

Waldemar Smolik, K. Zaremba, J. Marzec, 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. Obrebski;

Mar. 01, 2019 – Feb. 28, 2023

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 M.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.

- [Edu101] **Modification M.Sc. Studies: Telecommunications in the frame of Knowledge – Education – Development - Cooperation Project** (Modyfikacja studiów drugiego stopnia na kierunku „Telekomunikacja" w ramach projektu NERW2 PW: Nauka – Edukacja - Rozwój - Współpraca)

Andrzej Buchowicz, P. Bobiński, K. Godziszewski, K. Ignasiak, P. Korpas, S. Kozłowski, R. Łukaszewski, J. Modelska, D. Rosołowski, W. Skarbek, W. Wojtasiak, J. Źera.

Mar. 01, 2019 – Feb. 28, 2023

EU Operational Programme Knowledge – Education – Development - Cooperation 2014-2021

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 M.Sc. academic programme by means of introduction two new specializations: Teleinformatics and Wireless and Multimedia Technologies using new teaching methods.

4. RESEARCH ACTIVITIES

4.1. International projects

[Pro1] **Super-Kamiokande to Hyper-Kamiokande (SK2HK)**

Marcin Ziembicki, R. Kurjata, A. Rychter, A. Klekotko, W. Obrebski, G. Pastuszak, A. Buchowicz, G. Galiński;

Nov. 01, 2019 – Oct. 31, 2023

Horizon 2020 EU Framework Programme
MSCA-RISE Action

The study of the neutrino properties and interactions has been key in the development of the Standard Model of fundamental interactions and it is providing first clues on the understanding of its deeper foundations. In this aspect the Super-Kamiokande (SK) detector (ICRR, U. Tokyo, Japan) for many years has played a crucial role. It contributed to the discovery of oscillations of atmospheric neutrinos, thus establishing their 'massive' character. Because of this discovery, Takaaki Kajita, the "person in charge of this proposal" from our main Third Country partner ICRR, was awarded with the Nobel Prize in Physics 2015. With SK2HK we aim to continue the very successful SKPLUS, through extension of participation of European institutes in the state-of-the-art experimental program related to the SK, the SK-Gd and the Hyper-Kamiokande (HK) experiments. We want to gain insight and even discover the hypothesized charge-parity violation in the leptonic sector with SK and the future HK. We want to discover the "Diffuse Neutrino Supernova Background" with SK-Gd and to explore in depth the Grand Unification with SK and the future HK. Those measurements are key to the complete understanding of the most fundamental concepts of Physics.

An important aspect of this proposal is significant amount of hardware R&D related to HK, especially given the decision to start HK construction in 2020. Timely finalization of these activities is crucial to the success of HK and requires even closer cooperation with our partners. Given the uniqueness of the technologies that are being developed, it is efficient to do some work at the location where most of the infrastructure needed for the R&D is. In this project those are the ICRR of the Univ. of Tokyo and the TRIUMF laboratory in Canada, as well as several European laboratories, incl. the applying institutions. The proposed secondment program offers a unique opportunity to fulfil these goals while working with World leading experts.

[Pro2] **Convergence of electronics and photonics technologies for enabling Terahertz applications** (Konwergencja elektroniki i technik fotonicznych na rzecz rozwoju zastosowań techniki).

Yevhen Yashchyshyn

D. Nyzovets;

Mar. 01, 2016 - Feb. 29, 2020

CELTA, Horizon 2020, EU Framework Programme for Innovative Training Networks.

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

CELTA was the acronym for Convergence of Electronics and Photonics Technologies for Enabling Terahertz Applications. CELTA aimed to produce the next generation of researchers who would enable

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

[Pro3] **Innovative optical/quasioptical technologies and nano-engineering of anisotropic materials for creating active cells with substantially improved energy efficiency** (Innowacyjne optyczne/quasi optyczne techniki oraz inżynieria nanomateriałów i materiałów anizotropowych dla opracowania struktur czynnych z zasadniczo poprawioną efektywnością energetyczną).

Yevhen Yashchyshyn, P. Bajurko, J. Sobolewski;

Feb. 01, 2018 - Jan. 31, 2022

IMAGE, Horizon 2020, EU Framework Programme for Innovative Training Networks.

The principal goal of the project is to combine research expertise in optics, crystallography and material 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] **High-precision technique of millimeter and sub-THz band characterization of materials for microelectronics** (Dokładne metody charakteryzacji materiałów dla mikroelektroniki w paśmie fal milimetryowych i subterahercowych).

Jerzy Krupka (the Institute of Microelectronics and Optoelectronics, WUT),

Paweł Kopyt (head on behalf of the Institute of Radioelectronics and Multimedia Technology); D. Gryglewski, M. Piasecki, W. Wojtasiak;
Nov. 01, 2016 – Oct. 31, 2021
TEAM-TECH, EU Framework Programme "Intelligent Development 2014-2020", and Foundation for the Polish Science.

The main objective of this project was 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 was two-pronged. On one hand, the said resonant structures was exploited to benefit from their inherent narrow-band properties, which are particularly useful at measuring low-loss materials. On the other hand, the research was also concerned broadband measurement techniques based on multimode resonant structures. The auxiliary goal was adopting the technological approaches typical for the microelectronics industry and apply them for precise fabrication of novel resonant cavities operating in the millimeter and the sub-THz bands. Another such goal was 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] **T2K experiment (Tokai To Kamionka)** (Eksperyment T2K) (Tokai To Kamionka).
Krzysztof Zaremba, R. Kurjata, M. Ziembicki, A. Rychter;
HARMONIA, International project is 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, Wrocław University, Silesian University; Oct. 10, 2012 - Sept. 22, 2022
Funded by the Ministry of Science and Higher Education

The main aim of this project is an upgrade of ND 280 detector, development of neutrino interactions simulation (NuWro) and data analysis software, responsibility for detector operation and its data quality.

[Pro6] **Experiment COMPASS – study of the internal structure of the nucleon** (Eksperyment COMPASS – badania wewnętrznej struktury nukleonu).
Krzysztof Zaremba, J. Marzec, R. Kurjata, M. Ziembicki, A. Rychter;
HARMONIA, International project realized in collaboration with the Andrzej Soltan National Centre for Nuclear Research and Faculty of Physics, Warsaw University. May 15, 2018 - May 14, 2020
Funded by the National Science Centre

The goal of this project is to experimentally study the internal, three-dimensional structure of the nucleon at the level of its elemental components. The project is

located in a new field of QCD research that goes beyond the one-dimensional description commonly used so far. A description of the three-dimensional structure of the nucleon is possible, either under TMD (Transverse Momentum Dependent Distributions) formalism or under GPD (Generalized Parton Distributions) formalism.

[Pro7] **Indoor and outdoor NITIC Plus 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-Joško; Oct. 01, 2017 - Mar. 31, 2020
IONIS, AAL Joint Programme
Funded by the National Centre for Research and Development

The IONIS project addressed the needs people with cognitive impairment and their caregivers. Its main objective was a development of a fully integrated and validated platform for health monitoring, home automation, personal agenda with reminders, alerts, caregiver administrative tools. IONIS intended 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.

[Pro8] **Radar inerative navigation assistance system based on on-board surface imagery using SAR technology** (Radarowy system wspomagania nawigacji inercyjnej w oparciu o pokładowe zobrazowanie powierzchni ziemi z wykorzystaniem technologii SAR).
Damian Gromek (ISE), D. Rosołowski; Jul. 16, 2018 – Jul. 15, 2021
Funded by the National Centre for Research and Development

The aim of the project is to create and test a demonstrator of a system for developing corrections for inertial navigation based on radar imaging of the earth's surface in the synthetic aperture SAR (Synthetic Aperture Radar) technique.

[Pro9] **Integrated solution for innovative elderly care** (Zintegrowany system innowacyjnych rozwiązań dla opieki nad osobami starszymi).
Jerzy Kołakowski, V. Djaja-Joško, J. Cichocki, M. Kołakowski; Oct. 01, 2018 - Sept. 30, 2021
INCARE, 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.

- [Pro10] **The standardization of electromagnetic measurements of soil moisture, in short BDS&Soil** (Standardyzacja po-miarów elektromagnetycznych wilgotności gleby).
Jerzy Krupka (the Institute of Microelectronics and Optoelectronics, WUT), **Paweł Kopyt** (head on behalf of the Institute of Radioelectronics and Multimedia Technology, WUT), B. Salski, T. Karpisz; Dec. 01, 2018 - Nov. 30, 2020
NAWA Programme
Funded by the Polish National Agency for Academic Exchange

The project was elaborated in the co-operation with the Institute of Agrophysics, Polish Academy of Science, Utah State University (USA), the Institut Fresnel, Equipe HIPE, Centre Scientifique de Saint Jerome (France), Center for Ecology and Hydrology, James Cook University (UK), and the Institute of Optoelectronics and Microelectronics, WUT.

The main goal of the project would be the research on a method to measure the humidity of soil samples, which was based on a single-mode high-quality resonator operating in the microwave band. The humidity of a sample under test was recorded indirectly as the Q-factor of the activity. With properly selected resonant mode excited within the resonator even samples of high water contents could be measured with the proposed set-up without problems with overdamping of the resonance.

- [Pro11] **Personalized ICT solution to reduce re-hospitalization rates in heart failure elderly patients suffering from comorbidities** (Zastosowanie spersonalizowanej technologii ICT w celu zmniejszenia ponownych hospitalizacji u starszych pacjentów z niewydolnością serca cierpiących na choroby współistniejące).
Jerzy Kołakowski, V. Djaja-Jośko J. Cichocki, M. Kołakowski; Sept. 01, 2020 – Mar. 31, 2023
ERA PerMed Program
Funded by the National Centre for Research and Development

Heart failure (HF) is a major and growing medical and economic problem, 70% of the elderly patients are readmitted to hospital within one year, making re-hospitalization an ongoing medical challenge. In this context, the PerHeart project is employing Information and Communication Technology with the main goal of reducing re-hospitalization rates in HF patients. The PerHeart ICT platform will integrate in a modular design functionalities dedicated to HF patients and their professional caregivers. The underlying artificial intelligence software will adapt to the patient's needs while collected data in three countries (Poland, Denmark, Italy) will help elucidate specific risk factors for readmission while taking gender and socio-economic aspects into account and help interpretation and prediction of complex multifactorial disease while also providing input for focused intervention.

4.2.2. Research grants

- [Pro12] **Development of a prototype radar fire control multi-phase scanning beam in two planes for a set of medium-range missile OP, codenamed Vistula** (Opracowanie prototypu radaru wielofunkcyjnego

kierowania ogniem ze skanowaniem fazowym wiązki w dwóch płaszczyznach dla zestawu rakietowego OP średniego zasięgu, kryptonimem WISŁA).

Wojciech Wojtasik, 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 was to design a conception and project of N/O module with 10 W element radiating at X band, considering the limitations of raster scanning antenna radiating elements in a wide.

- [Pro13] **Full-wave electromagnetic modeling of coherent radiation in electrically-pumped metal-clad semiconductor micro-lasers with a folded metallic resonator** (Pełnofałowe modelowanie elektromagnetyczne zjawiska generacji promieniowania koherentnego w pompowanych elektrycznie laserach półprzewodnikowych z metalizowanym rezonatorem składanym).
Bartłomiej Salski, P. Kopyt, M. Kryszicki; Sept. 16, 2015 - Nov. 15, 2020
SONATA Programme
Funded by the National Science Centre

The main goal of the project was 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 was accounted 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 was the novelty when compared to alternative solutions known in literature. The elaborated method was applied to the research on a new type of metal-clad semiconductor lasers with a prism-like folded micro-cavity.

- [Pro14] **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 was elaborated in the co-operation with the Military University of Technology, Wrocław 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 was 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 involved 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 was 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 was to take place in the form of technology demonstrators, and in the second stage, in the context of devel-

opment work was assumed to develop their prototypes, programs and methodologies qualification tests. Design qualification tests were 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.

- [Pro15] **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 was 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 was 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 would be developed.

- [Pro16] **An innovative alarm system with integrated SmartHome solutions and operation via mobile applications** (Innowacyjny system alarmowy umożliwiający integrację z rozwiązaniami SmartHome oraz obsługę przez aplikacje mobilne).

D. Rosołowski (head on behalf of the Institute of Radioelectronics and Multimedia Technology, WUT)

Jul. 16, 2018 – Jul. 15, 2021

Project in the frame of **NAVSAR** (Radarywy system wspomagania nawigacji inercyjnej w oparciu o pokładowe zobrazowania powierzchni ziemi z wykorzystaniem technologii SAR) realized in the Institute of Electronic Systems, WUT.

Funded by the National Centre for Research and Development

Expertises, measurements and modifications including radio communication modules, antennas and algorithms. Design of a testbed for measuring radiation pattern of alarm sensors as well as preliminary tests in electromagnetic compatibility. The project covered a total of 17 separate tasks.

- [Pro17] **Correlations between electromagnetic and magnetoelastic properties of ferromagnetic thin films** (Korelacje pomiędzy właściwościami elektromagnetycznymi i magnesosprężystymi cienkich warstw ferromagnetycznych).

Jerzy Krupka (the Institute of Microelectronics and Optoelectronics), **B. Salski**

(head on behalf of the Institute of Radioelectronics and Multimedia Technology, WUT), A. Pacewicz, P. Kopyt; Jun. 18, 2019 - Jun. 17, 2022

OPUS 16

Funded by the National Science Centre

The project is realized in collaboration between the Warsaw University of Technology and the Institute of Physics, Polish Academy of Science. The main goal of the project is to find out correlations between magnetoelastic and magnetic damping properties of several groups of magnetic thin films. Rigorous quantitative study of various contributions to the magnetic damping occurring in thin films will be undertaken in a broad electromagnetic spectrum. Another goal will be to find the conditions for the excitation of a magnetic plasmon in the planar structures.

- [Pro18] **Coma and consciousness disorders – new prognostic and diagnostic indicators based on EEG and MRI** (Śpiączka i zaburzenia świadomości – nowe wskaźniki prognostyczne i diagnostyczne oparte o EEG i MRI).

Piotr J. Durka (Warsaw University, Faculty of Physics), P. Bogorodzki (head on behalf of the Institute of Radioelectronics and Multimedia Technology, WUT), P. Bogorodzki, E. Piątkowska-Janko, K. Lipiński; Jul. 16, 2019 - Jul. 15, 2022

OPUS 16

Funded by the National Science Centre

Awareness-raising mechanisms are one of the greatest mysteries. Among the leading directions to their cognition are the study of patients in states of impaired consciousness (disorders of consciousness, DoC) - both in terms of hopes of broadening the basic knowledge of these processes, as well as the high demand for a method of diagnosis based on the results of these studies. Existing research in this area has shown promising results in the use of methods of Magnetic Resonance Imaging (MRI) and electroencephalography (EEG). However, the existing use of both methods in assessing the DoC are based on relatively weak methodological analyses of EEG and MRI signals, resulting in suboptimal sensitivity and less than achievable specificity. Furthermore, the absence of a combination of these two methods in the previous literature in longitudinal studies, conducted by all stages of the evolution of consciousness disorder, from the beginning of coma. The completion of these gaps in modern research is the basis of this project.

- [Pro19] **Intelligent Decision Support System based on the Algorithmic Image Analysis in the Operations of the Justice System** (Inteligentny system wspomagania decyzyji oparty na algorytmicznej analizie obrazu w działaniach służb wymiaru sprawiedliwości).
Piotr Bilski, W. Smolik, K. Słopek (members of the Steering Committee);
Dec. 20, 2019 – Dec. 20, 2022
BIO10 Programme
Funded by the National Centre for Research and Development

The topic of the project is the design and implementation of the intelligent system monitoring behavior and actions of people held in the penitentiary institutions. Its aim is to enable detection and prevention of dangerous and unwanted situations, such as physical assault or drug abuse. The system is to be operating on multiple industrial cameras monitoring inmates in various locations. Based on the images and videos acquired from them the selected Artificial Intelligence method will be used to identify dangerous situations and warn the guards in the timely manner. The important feature is the ability to use information from multiple cameras and combine them into the complex system. In the project specialists in criminology, penitentiary system, image analysis and intelligent data processing methods are involved.

- [Pro20] **Research and simulations of effects of HPM impulses** (Badania i symulacje skutków oddziaływanego impulsów HPM).
Bartłomiej Salski, M. Kryszicki, P. Kopyt; Feb. 13, 2019 - Dec. 28, 2023
Strategic research and development program
Funded by the National Centre for Research and Development

The project aims at developing an electromagnetic simulation platform dedicated to the analysis of the attack with high power microwave pulses..

4.2.3. Grants for young researchers

- [Pro21] **Modeling and optimization of four wave mixing in microstructured optical fibers for terahertz radiation generation** (Modelowanie i optymalizacja mieszaniny czterofalowego we włóknach światłowodowych na potrzeby generacji promieniowania terahercowego).
Adam Pacewicz, B. Salski; Sept. 22, 2017 - Mar. 22, 2020
Diamond Grant
Funded by the Ministry of Science and Higher Education

Terahertz radiation has a great potential to be more widely applied and commercialized in areas such as 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 was 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 would be undertaken, taking available technological capabilities into account.

- [Pro22] **Accurate methods of materials spectroscopy in mm-wave and sub-THz frequencies** (Dokładne metody spektroskopii materiałów w paśmie milimetrowym i sub-terahercowym).
Jerzy Cuper, P. Kopyt;
Jul. 30, 2019 - Jul. 30, 2021
Diamond Grant
Funded by the Ministry of Science and Higher Education

The purpose of this project is to develop new, accurate and reliable methods for material characterization in mm-wave and sub-THz frequencies, where most of the high-tech industry is now carrying out researches for 5G and IoT. Work will be focused on resonant methods, especially on Fabry-Perot open resonator structure. Firstly, a dedicated setup for both low-loss materials and conductive samples will be considered at 50-110 GHz frequencies. Second task assumes coupling such resonator with 300-4000 GHz THz time-domain spectrometer (THz TDS) and perform measurements with unprecedented accuracy. Both setups will be designed, fabricated partly at the Warsaw University of Technology, and tested within this project.

- [Pro23] **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, 2021
PRELUDIUM
Funded by the National Science Centre

The project was oriented on testing the hypothesis that the ultra-low-power impulse-radar sensors and infrared depth sensors could 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 could 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 was, 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.

- [Pro24] **START 2020 Program**
Grzegorz Bogdan;
May 13, 2020 – May 13, 2021
Scholarship
Funded by the Foundation for Polish Science

The START scholarship of the Foundation for Polish Science has been granted for a scientific contribution to the field of adaptive beamforming in time-modulated antenna arrays. It is directed to young researchers, at the outset of their career, who have

- [Pro25] **Feasibility study of time-modulation for antenna arrays in millimetre wave band** (Ocena możliwości zastosowania metody modulacji czasowej do szyków antenowych w zakresie fal milimetrowych).

Grzegorz Bogdan;
Nov. 18, 2020 – Nov. 18, 2021

MINIATURA

Funded by the National Science Centre

The main goal of this project is to conduct a preliminary research on a time-modulated antenna array (TMAA) operating in the millimetre wave band. The TMAA with switches and a control circuitry will be designed and the whole system will be measured in the anechoic chamber. Excepted outcomes of the project include a qualitative examination of feasibility and determination of effects which appear at the millimetre range and affect the TMAA performance. The project is funded by the National Centre of Science under MINIATURA programme.

4.3 Projects granted by the University

4.3.1 Priority Research Area Grants

- [Pro26] **Effective methods for electromagnetic coupling with Fabry-Perot Open resonator in THz frequency band** (Opracowanie efektywnych metod dostarczania energii pola elektromagnetycznego do wnęki otwartego rezonatora Fabry-Perot pracującego w paśmie terahercowym).

Paweł Kopyt, B. Salski, J. Cuper,
A. Pacewicz, T. Karpisz;
Jul. 21, 2020 – Dec. 31, 2021

Project granted by the Scientific Council for Automatic Control, Electronics and Electrical Engineering, WUT.

The main goal of this project is to elaborate and optimize two alternative methods of coupling of electromagnetic wave with Fabry-Perot open resonator's cavity. The effort will be divided into two tasks aimed at obtaining a set of numerical and mechanical models of structures with couplings, which provide as weak loss of cavity's Q-factor as possible. Each measurement and numerical analysis will be taken in sub-THz and THz frequency band.

- [Pro27] **Modern electronics, digital signal processing and data compression algorithms for high energy physics experiments** (Nowoczesna elektronika oraz algorytmy przetwarzania sygnałów i kompresji danych dla fizyki wysokich energii).

R. Kurjata, A. Rychter, J. Marzec,
K. Zaremba, W. Obrebski, G. Pastuszak,
A. Buchowicz, G. Galiński, M. Ziembicki,
A. Klekotko;

Jul. 01, 2020 – Dec. 31. 2021
Project granted by the Scientific Council for Biomedical Engineering, WUT.

The goal of the project is the integration and growth of a research team involved in several physical experiments within the process of the implementation of the planned research program. It covers various issues

already achieved some success in their field. The stipends serve as recognition of the scientific attainments so far by these young scholars and as an incentive for further growth by enabling them to devote themselves fully to their research.

related to the competence of team members, ranging from test stands for the development of the ND280 near detector in the T2K experiment, through the characterization of photomultipliers for the HYPER-K experiment and its intermediate IWCD detector (Intermediate Water Cherenkov Detector), tests and analysis of test data of elements detectors (IWCD, ND280, AMBER, SPD @ NICA), ending with unique solutions in the field of signal analysis and data stream compression in the HYPER-K, COMPASS ++ / AMBER and SPD @ NICA experiments. In particular, the latter task presents the generality of the proposed solutions and the ability to easily adapt to changing requirements.

4.3.2 Internal grants

- [Pro28] **A Fabry-Perot open resonator with a Bragg gratings made by 3D printing** (Otwarty rezonator Fabry-Perot z siatką Bragga wykonaną metodą druku 3D).

Bartłomiej Salski, T. Karpisz, M. Krysicki;
Jul. 27, 2020 – Sept. 30, 2021.
Project granted by the Scientific Council for Automatics, Electronics and Electrical Engineering, WUT.

The goal of this project will be research on the application of Bragg gratings increasing spectral resolution of a Fabry-Perot open resonator operating in the 20-110 GHz range. It will open the way for more accurate electromagnetic characterization of low-loss materials for 5G applications.

- [Pro29] **Analysis of selected obstetric factors influence on the bioelectric uterine activity signal parameterization** (Analiza wpływu wybranych czynników położniczych na sposób parametryzacji sygnału biolektrycznej aktywności macicy).

Dariusz Radomski;
Jul. 21, 2020 – Dec. 31, 2021.
Project granted by the Scientific Council for Biomedical Engineering, WUT.

The aim of the study is to assess selected maternal health factors on the values of the most frequently described EHG signal parameters. Factors to be analyzed will include: maternal age, sequence of pregnancy, smoking, gestational diabetes, placenta location, BMI, previous cesarean section. For EHG signal parameterization, the mean signal power, mean frequency, median frequency, dominant frequency, approximate entropy value, and some parameters of the image of the distribution of excitations measured with a 16-channel electrohysterograph will be used.

- [Pro30] **Hospital information system based on openEHR system – analysis of efficiency** (Szpitalny system informacyjny oparty na standardzie openEHR – analiza wydajności).

Jacek Kryszyn;
Jul. 21, 2020 – Dec. 31, 2021.
Project granted by the Scientific Council for Biomedical Engineering, WUT.

The purpose of the project is to create a hospital information system using the openEHR standard and to analyze the efficiency of such a solution. The project will result in a comparison of the performance of a classic hospital information system based on a proprietary relational database and one based on the openEHR standard. The average user considers an application functional if the content appears within 2 seconds or less. It can be expected that a user such as a doctor cannot afford to wait too long due to the nature of his work. Therefore, the conditions under which this requirement is met (the amount of data in the system, parameters of the machine on which the system operates) will be determined. The results will be summarized in a scientific article.

- [Pro31] **Research on magnetic nanoparticles for hyperthermia by means of MPS method** (Badanie nanocząsteczek magnetycznych w zastosowaniu do hipertermii metodą MPS).
Przemysław Wróblewski, M. Midura;
Jul. 21, 2020 – Dec. 31, 2021.
Project granted by the Scientific Council for Biomedical Engineering, WUT.

The aim of the project is to develop a measurement system to determine the magnetic losses of particles based on the analysis of their complex magnetic susceptibility and to conduct preliminary experiments for selected magnetic nanoparticles.

- [Pro32] **Measurement the hydrodynamic diameter of nanoparticles by means of nuclear magnetic resonance (NMR)** (Pomiar średnic hydrodynamicznych nanocząsteczek metodą jądrowego rezonansu magnetycznego (NMR)).
Michał Wieteska, K. Lipiński;
Jul. 21, 2020 – Dec. 31, 2021.
Project granted by the Scientific Council for Biomedical Engineering, WUT.

Interest in magnetic nanoparticles and their potential use in medicine has been increasing in recent years. Those particles may serve as contrast agents in Magnetic Resonance Imaging (MRI), Myocardial Perfusion Imaging (MPI) or be used for cancer treatment (hyperthermia). In recent years many manufacturers started producing various types of magnetic nanoparticles (they differ in regards such as core and shell material). Although the market is vast, the datasheets for this products often lack information required for calculating their magnetic properties. Optimizing the power loss of those particles is crucial in aforementioned diagnostics and hyperthermia therapy. In MRI and MPI we want to minimize the power loss to protect the patient, whereas in cancer treatment we wish to maximize the power for more efficient elimination of cancerous cells. Power loss in magnetic nanoparticles is strongly correlated with their hydrodynamic diameter. In this study we will perform Spin-Echo (SE) and Inversion-Recovery (IR) experiments, calculate the T1 and T2 relaxation times of nanoparticles, perform Diffusion Weighted Imaging (DWI) and use Stokes-Einstein law to calculate their diameters. In the future we will combine our method with electromagnetic method of measuring the hydrodynamic diameter, compare the results and propose a reliable method for such measurement.

4.4. Other projects

- [Pro33] **An innovative alarm system with integrated SmartHome solutions and operation via mobile applications** (Innowacyjny system alarmowy umożliwiający integrację z rozwiązaniami SmartHome oraz obsługę przez aplikacje mobilne).
Dawid Rosołowski (head from the Institute of Radioelectronics and Multimedia Technology, WUT);
Jul. 08, 2019 – Oct. 08, 2020
Funded by EBS sp.z.o.o., 3E Production spółka komandytowa.

Expertises, measurements and modifications including radio communication modules, antennas and algorithms. Design of a testbed for measuring radiation pattern of alarm sensors as well as preliminary tests in electromagnetic compatibility. The project covered a total of 17 separate tasks.

- [Pro34] **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 Smoliak, 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 was to create a mobile tomographic system for 3D imaging and area monitoring using the node potential map. The system would consist of a mobile device that allowed the simultaneous recording of electrical potentials of cardiac activity and lung ventilation.

- [Pro35] **Imaging studies of small animal brain using MRI techniques** (Badania obrazowe mózgu małych zwierząt z wykorzystaniem techniki MRI).
Piotr Bogorodzki, E. Piątkowska-Janko, W. Obrębski, M. Wieteska;
Jun. 20, 2018 - Jun. 20, 2020
Funded by Neurovet Małgorzata Mikuła.

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

- [Pro36] **Use of equipment with the testing instrumentation** (Udostępnienie mikrofalowej aparatury pomiarowej).
Wojciech Wojtasik;
Nov. 02, 2019 - Apr. 30, 2020
Funded by QWED sp.z.o.o.

The aim of this project was to develop a measurement setup for dielectric materials. The QWED company would participate in the research conducting at the Radiocommunications and Radiolocation Division, Institute of Radioelectronics and Multimedia Technology. The device mentioned above was able to support

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modern measurement technology for high frequency ranges.

- [Pro37] **Designing RF circuits for LTE 450 MHz base station for critical applications** (Projektowanie obwodów RF do stacji bazowej LTE 450 MHz do zastosowań krytycznych).
Daniel Gryglewski
Jul. 01, 2020 – Dec. 31, 2022
Funded by IT Partners Telco sp.z.o.o.

The aim of this work is to design and test RF circuits for the newly developed LTE base station intended for critical applications. The system are to operate in the LTE 450 MHz band (B31).

The Institute of Radioelectronics and Multimedia Technology acts as a sub-contractor of IT Partners Telco. The contract is carried out as a part of the National Centre for Research and Development project "LTE -Advanced 450 MHz Micro Base Station for Critical – Mission Systems", implemented under the "Path for Mazovia" program.

- [Pro38] **Characterization of the antennas and antenna arrays in X-band** (Badanie anten i szkóów antenowych na pasmo X).
Grzegorz Bogdan;
Jan. 01, 2020 – Dec. 31, 2020
Funded by Advanced Protection Systems SA.

The project included several small works which were conducted under a framework agreement established in 2019 between the Advanced Protection Systems and the Institute of Radioelectronics and Multimedia Technology. The goal was to characterize different designs of antennas and antenna arrays. The radiation pattern, gain and return loss of each antenna under test was measured in the X-band inside an anechoic chamber.

- [Pro39] **Research and development works in the area of developing and implementing an integrated modern breakthrough trading platform in terms of performance and capacity parameters as well as innovative communication protocols and transaction algorithms** (Usługi badawcze i eksperckie w celu realizacji projektu pt. "Przeprowadzenie prac badawczo-rozwojowych w zakresie opracowania oraz implementacji zintegrowanej nowoczesnej Platformy Transakcyjnej przełomowej pod względem parametrów wydajnościowych i pojemnościowych oraz nowatorskich protokołów komunikacyjnych oraz algorytmów zawierania transakcji").
Waldemar Smolik, A. Rychter, J. Kryszyn, D. Wanta;
Jan. 04, 2020 – Apr. 06, 2020
Funded by Giełda Papierów Wartościowych w Warszawie S.A. (Warsaw Stock Exchange).

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

- [Pro40] **Measurement examination of transmitter module for 94 GHz band** (Pomiar charakterystyk modułu nadajnika na pasmo 94 GHz).
Paweł Bajurko, S. Kozłowski;

Feb. 01, 2020 – Feb. 15, 2020
Funded by SRC sp.z.o.o.

Characteristics of the transmitter module for 94 GHz band were determined using mm-wave-on-wafer measurement system performing direct probe contact to the dice.

- [Pro41] **Measurement of antenna characteristics – antenna for S-band** (Pomiary charakterystyki antenowej – antena na pasmo S).
Paweł Bajurko, J. Sobolewski;
Jun. 02, 2020 – Jun. 30, 2020
Funded by WiRan sp.z.o.o.

Spatial distributions of axial ration and circular polarization gain of the antenna for the S band were examined in this work.

- [Pro42] **Measurement examination of the integrated circuit of the receiver for the 94 GHz band** (Pomiar charakterystyk układu scalonego odbiornika na pasmo 94 GHz).
Paweł Bajurko;
Jun. 08, 2020 – Jun. 30, 2020
Funded by SRC sp.z.o.o.

Characteristics of the integrated circuit of the receiver for the 94 GHz band were determined using mm-wave-on-wafer measurement system performing direct probe contact to the dice.

- [Pro43] **Examination of S parameters of a set of antenna and two-port devices in the 75-77 GHz frequency range** (Badanie parametrów S zestawu anten i dwuwojtników w zakresie częstotliwości 75-77 GHz).
Paweł Bajurko;
Jul. 20, 2020 – Sept. 19, 2020
Funded by THORIUM SPACE sp.z.o.o.

S-parameters of antennas and two-port devices operating in 75-77 GHz band were examined in this work.

- [Pro44] **Measurement of the noise parameters of the receiver's integrated circuit for the 94 GHz band** (Pomiar parametrów szumowych układu scalonego odbiornika na pasmo 94 GHz).
Paweł Bajurko;
Jul. 30, 2020 – Sept. 11, 2020
Funded by SRC sp.z.o.o.

Noise parameters of the integrated circuit of the receiver for the 94 GHz band were determined using mm-wave on-wafer measurement system performing direct probe contact to the dice.

- [Pro45] **Workshop on radio engineering** (Kurs radiotechniczny).
Grzegorz Bogdan, P. Bajurko, K. Godziszewski, W. Kazubski;
Jul. 20, 2020 -Jul. 24, 2020
Funded by the Faculty of Power and Aeronautical Engineering, WUT.

The workshop was organized for a group of 8 students and researchers of the Faculty of Power and Aeronautical Engineering, Warsaw University of Technology. It covered fundamentals of antennas, propagation of radio waves, modulations, and construction of radio transceivers. The workshop included 7 hours of lectures and 3 hours of laboratories which were conducted inside the Antenna Laboratory of the Institute od Radioelectronics and Multimedia Technol-

ogy. The workshop was delivered on-line to the participants via the Microsoft Teams platform.

- [Pro46] **Realization of research and development expert works** (Realizacja prac o charakterze badawczo-rozwojowym i eksperckim).

Waldemar Smolik, A. Rychter, J. Kryszyn, D. Wanta;

Aug. 12, 2020 – Nov. 30, 2021

Funded by Giełda Papierów Wartościowych w Warszawie S.A. (Warsaw Stock Exchange).

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

- [Pro47] **Acoustic measurement of voice service kiosk** (Przeprowadzenie pomiarów akustycznych urządzenia voice service kiosk).

Jan Żera;

Sept. 04, 2020

Funded by M4B S.A.

The purpose of this project was to conduct acoustic measurement voice service kiosk. Self-service kiosks have entered the retail world for good. They are visually attractive, shorten queuing times and offer quick interaction.

- [Pro48] **Acoustic measurement at the main concert hall, chamber concert hall, and orchestra rehearsal room at the Podlasie Opera and Philharmonic** (Przeprowadzenie pomiarów akustycznych w sali głównej, kameralnej i próby orkiestry Opery i Filharmonii Podlaskiej).

Jan Żera;

Oct. 10, 2020 – Dec. 15, 2020

Funded by Manufaktura Technologiczna

The purpose of the project was to describe the present acoustical conditions in the main Concert Hall, Chamber Concert Hall, and orchestra Rehearsal Room at the Podlasie Opera and Philharmonic.

- [Pro49] **Examination of radiation patterns of antennas in the far field zone in the 71.8-78 GHz frequency range** (Badanie charakterystyk kierunkowych promieniowania anten w strefie dalekiej w zakresie częstotliwości 71,8-79 GHz).

Paweł Bajurko, Jakub Sobolewski;

Oct. 12, 2020 – Nov. 16, 2020

Funded by THORIUM SPACE sp.z.o.o.

During this work, the radiation patterns of antennas were examined in the 71.8-79 GHz frequency range. The antennas subjected to examination operate with linear and circular polarization. The measurements were conducted in the far field zone at a distance of 2.5 m.

- [Pro50] **BST/polymer composites tunability studies in the frequency range up to 500 GHz** (Badania przestrzegalności kompozytów BST/polimer w zakresie częstotliwości do 500 GHz).

Yevhen Yashchyshyn, K. Godziszewski;

Oct. 19, 2020 – Jul. 31, 2022

Funded by the Faculty of Chemistry, WUT.

The project is carried out as part of NCN's project **SHENG 1 – Polish-Chinese Funding Initiative**. SHENG-1 is focused on the cooperation between Warsaw University of Technology and Northwestern

Polytechnical University to jointly elaborate BST/polymer dielectric tunable functional composites by tape casting. The main emphasis is put on the influence of BST particles, polymer type, BST/polymer interactions and composite structure on the microstructure and dielectric properties of materials. The important parameter will be the dielectric tunability of composite materials in sub-THz frequencies. Dielectric tunability theoretical model of ceramics/polymer functional composites is the key issue of the project. It allows to design and test high dielectric tunable composites. Testing BST/polymer composites under the microwave and sub-THz frequencies is the main goal of the part of the project that is done in Antennas and sub-THz Technology Group as the subtask.

- [Pro51] **Examination of shielding effectiveness of EMI shielding materials in the microwave frequency range** (Badanie skuteczności ekranowania materiałów do ochrony EM w paśmie mikrofalowym).

Paweł Bajurko;

Nov. 11, 2020 – Dec. 18, 2020

Funded by GISS sp.z.o.o.

Shielding effectiveness of a set of EMI shielding materials was examined in this work in the 1-26 GHz frequency band.

4.5. Other activities

4.5.1 Partnership

4.5.1.1. International Co-operation

CC-Link

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

China – Poland Exchange Program

The Institute of Radioelectronics and Multimedia Technology (Nuclear and Medical Electronics Division) in collaboration with the Institute of Engineering Thermophysics (IET), Chinese Academy of Sciences, China, realized the new exchange program: "Advanced process monitoring technologies for multiphase flows". The aim of this program is to explore how to investigate the multi-phase flows based on process tomography and process CFD simulation to analysis the complex flow characteristics. Exchange plan include scholars from IET visiting the Institute of Radioelectronics and Multimedia Technology, Warsaw University of Technology (WUT). Head of the research group: **Waldemar Smolik**

4.5.1.2. National Co-operation

IUSER

The new established science and technology platform: "Intelligent Devices and Systems for Distributed Power Generation" is carried out at Institute of Radioelectronics and Multimedia Technology, Military University of Technology, National Institute of Telecommunications, Military Communication Institute, Na-

tional Chamber of Electronics and Telecommunications, TP SA., Institute of Electron Technology. The main aim of this project is to conduct the research on technologies and products, the implementation of which will create a market opportunity for the development of distributed generation based on renewable energy sources.

Intelligent Transport

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

CentriX

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

Waldemar Smolik

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 Radioelectronics and Multimedia Technology making the equipment available for IT Partners Telco LTD. to conduct the research activities possible through this project.

Microwave Microscopy for Advanced and Efficient Materials Analysis and Production

Przemysław Korpas;

MMAMA Project - research and innovation programme under European Union **Framework Programme - HORIZON 2020**

2017-2020

Cooperation with QWED company focused on development of accurate microwave Q-Meter device for 10 GHz Split-Post Dielectric Resonators and algorithms for special resolution improvements of scans performed with such a resonator.

4.5.2. Scientific networks

Subsystem Developed Through IMWP for Wireless Communication and Radar Functionalities – WG2 work group, IMWP for 5G – WG3 work group.

Yevhen Yashchyshyn;

COST – European Cooperation in Science & Technology supported by **EU Framework Programme HORIZON 2020**

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 Neutrino)

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

Polish Network of Particle Astrophysics (Polska Sieć Astrofizyki Cząstek)

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

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

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

4.5.3. Student research groups

Space Engineering Student Research Group

Krzysztof Kurek – tutor.

Space Engineering Student Research Group – SKIK (in Polish Studenckie Koło Inżynierii Kosmicznej) was formed in 2004. Members of SKIK participated in different international and internal educational space projects. i.e. ESEO, PW-Sat, BOBAS balloon mis-

sions. 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 used 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 IoT 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 - 2020

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 con-

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

4.6.3. Sub-terahertz Technology and Antenna Laboratory

Yevhen Yashchyshyn, P. Bajurko;

2010 – 2020

Funded by European Regional Development Fund (ERDF) in scope of Operational Programme Innovative Economy (POIG).

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

tract for the execution and financing of the Panda 2

4.6.4. Fast-X Laboratory: Electrical Capacitance Tomograph (Laboratorium Fast-X: Elektryczny tomograf pojemnościowy).

Waldemar Smolik, J. Kryszyn, R. Szabatin (em.), M. Krzewski, T. Olszewski, B. Radzik, P. Wróblewski, D. Wanta, M. Stosio;

2019-2021

Funded by European Regional Development Fund (ERDF) in scope of Regional Operational Programme for Mazovian Voivodeship – PRO-WM

The project is elaborated in the co-operation with the National Center for Nuclear Research in Świeck, where has been set up a research and implementation centre for CentriX industrial radiation techniques. One of the key equipments, which is established at the National Centre for Research and Development, is the most modern modular accelerator capable of speeding up electrons up to energy of 30 MeV. The accelerator is a part of the Fast-X Laboratory within the CentriX project.

5. TITLES AND DEGREES AWARDED

5.1. Ph.D. Degrees

- [PhD1] Marcin Góralczyk: "A S-band inverted 3-way Doherty amplifier with GaN HEMT transistors", Assoc. Prof. **W. Wojtasiak** (supervisor), Ph.D. degree with honours, Warsaw, Sept. 22, 2020.
- [PhD2] Tomasz Karpisz: "Nowe metody charakteryzacji materiałów dielektrycznych w zakresie mikrofalowym oraz fal milimetrowych" (Novel methods for characterization of dielectric materials at microwave and millimeter-wave frequencies), Assoc. Prof. **B. Salski** (supervisor), Ph.D. degree with honours, Warsaw, Sept. 21, 2020.
- [PhD3] Dawid Kuchta: "Zastosowanie mikrofalowych tranzystorów GaN HEMT we wzmacniaczach mocy dla radarowych modułów N/O" (Application of GaN HEMT microwave transistors in amplifiers for T/R radar modules), Assoc. Prof. **W. Wojtasiak** (supervisor), Warsaw, Sept. 15, 2020.
- [PhD4] Przemysław Piasecki: "Anteny sub-THz w technologii LTCC" (Sub-THz antennas in LTCC technology), Full Prof. **Y. Yashchyn** (supervisor), Warsaw, Sept. 14, 2020.
- [PhD5] Jakub Wagner: "Regularised numerical differentiation of measurement data in systems for healthcare-oriented monitoring of elderly persons", Full Prof. **R. Z. Morawski** (supervisor), Ph.D. degree with honours, Warsaw, Jun. 26, 2020.
- [PhD6] Marcin Ziembicki: "Scintillating fiber detectors for high energy physics experiments", Assoc. Prof. **J. Marzec** (supervisor), Ph.D. degree with honours, Warsaw, May 12, 2020.

5.2. M.Sc. Degrees

- [MSc1] Mirosław Bogusz: "Obrazowanie dynamiki neurometabolitów w funkcjonalnej spektroskopii rezonansu magnetycznego" (Imaging of neurometabolites dynamics using functional magnetic resonance spectroscopy), Assoc. Prof. **P. Bogorodzki** (supervisor).
- [MSc2] Marek Czelij (Institute of Control and Computation Engineering, WUT): "Algorytmy detekcji twarzy w obrazie i ich implementacja w systemach wbudowanych" (Face detection algorithms in image and their implementation in the embedded systems), Assist. Prof. **G. Galiński** (supervisor).
- [MSc3] Monika Dwojak: "Analiza obrazów RTG klatki piersiowej zwierząt w celu detekcji mięśnia sercowego" (Analysis of the chest X-ray images of the animals for the detection of the heart), Assoc. Prof. **P. Bilski** (supervisor).
- [MSc4] Santiago Galindo Cardenas: "Antena foto-niczna do transmisji MIMO w kierunku aplikacji 5G" (Photonic antenna for MIMO transmission towards 5G applications), Assist. Prof. **K. Godziszewski** (supervisor).

- [MSc5] Krzysztof Dygnerowicz: "System akwizycji danych ze scyntykamery" (Data acquisition system from scinticamera), Assist. Prof. **A. Rychter** (supervisor).
- [MSc6] Jan Jakub Gawlik: "Projekt szyku antenowego typu Van Atta pracującego na częstotliwości 24 GHz" (Van Atta antenna array's project operates at a frequency of 24 GHz), Full Prof. **Y. Yashchyn** (supervisor), M.Sc. degree with honours.
- [MSc7] Michał Gogół (Institute of Control and Computation Engineering, WUT): "Porównanie technologii wytwarzania oprogramowania „Low-Code” oraz tradycyjnej na przykładzie aplikacji webowej z elementami IoT" (Comparison of software development technologies „Low-Code” and traditional one based on example of web application with IoT elements), Assist. Prof. **P. Korpas** (supervisor), Warsaw University of Technology Distant Learning Center (Ośrodek Kształcenia na Odległość PW).
- [MSc8] Robert Grodecki: "Wizualizacja danych geotechnicznych w technologii HTML5" (Visualization of geotechnical data in HTML5), Assoc. Prof. **P. Bilski** (supervisor).
- [MSc9] Svetlana Karpova: „Modelowanie detekcji promieniowania Czerenkowa metodą Monte Carlo” (Modeling of Cherenkov radiation detection by the Monte Carlo method), Assist. Prof. **G. Domański** (supervisor).
- [MSc10] Adam Klekotko: „System do monitoringu stabilności fotopowielaczy” (System for photomultiplier stability monitoring), Assist. Prof. **G. Domański** (supervisor).
- [MSc11] Michał Kocon: „System do lokalizacji wewnętrz pomieszczeń” (Development of an indoor localization system for UWB nodes), Assist. Prof. **J. Kołakowski** (supervisor).
- [MSc12] Ewelina Kordyś: „System do archiwizacji i przechowywania danych medycznych” (System for archiving and storing medical data), Assist. Prof. **R. Kurjata** (supervisor).
- [MSc13] Bartosz Kościug (Institute of Telecommunications, WUT): "System detekcji ataków typu phishing z wykorzystaniem sztucznej inteligencji" (Phishing detection system based on Artificial Intelligence), Assoc. Prof. **P. Bilski** (supervisor).
- [MSc14] Olga Krawczyk: „Metody klasyfikacji danych z badań transkryptomicznych” (Methods for transcriptomics data classification), Assist. Prof. **T. Rubel** (supervisor).
- [MSc15] Michałina Kryjan: „Mobilne wspomaganie samokontroli i terapii insulinowej w cukrzycy” (Mobile decision and insulin therapy

- support for diabetes), Full Prof. **A. Przełaskowski** (supervisor).
- [MSc16] Katarzyna Kułak: „*Analiza ilościowa białek na podstawie danych ze spektrometrii mas ze znacznikami izobarycznymi*” (Quantitative analysis of proteins using mass spectrometry data with isobaric labeling), Assist. Prof. **T. Rubel** (supervisor).
- [MSc17] Daria Kukareka: “*Analiza porównawcza algorytmów detekcji, śledzenia oraz rozpoznawania samochodowych tablic rejestracyjnych w sekwencji wideo*” (Comparative analysis of algorithms for detection, tracking and recognition of car license plates in a video sequence), Assist. Prof. **A. Buchowicz** (supervisor).
- [MSc18] Katarzyna Lis: „*Implementacja metody BEAS do segmentacji dwuwymiarowych danych echokardiograficznych*” (Implementation of the BEAS method for segmentation of two-dimensional echocardiographic data), Assist. Prof. **S. Cygan** (supervisor).
- [MSc19] Justyna Łabuś: “*Pomiar gęstości kości metodą radiografii cyfrowej*” (Measurement of bone density by digital radiography), Assist. Prof. **G. Domański** (supervisor).
- [MSc20] Michał Łucjan: “*Węzeł rozproszonyego systemu IoT do monitorowania parametrów środowiskowych*” (Node of a distributed IoT system for environmental parameters monitoring), Assist. Prof. **J. Kołakowski** (supervisor).
- [MSc21] Kamila Mańkowska: “*System do wizualizacji, analizy i archiwizacji obrazów tomografii komputerowej*” (System for visualization, analysis and archiving of computed tomography images), Assoc. Prof. **W. Smolik** (supervisor).
- [MSc22] Igor Dawid Markiewicz: „*Multimodalny system uczenia maszynowego do aplikacji medycznych*” (Multimodal machine learning system for medical applications), Full Prof. **W. Skarbek** (supervisor).
- [MSc23] Marta Matyszewska: “*Numeryczna ocena stanu naprężeń i odkształceń w endoprotezie stawu biodrowego*” (Numerical assessment of stresses and strain in the hip joint endoprothesis), Assoc. Prof. **M. Kwacz** (supervisor).
- [MSc24] Natalia Osiadła: „*Opracowanie układu do badania pracy serca z wykorzystaniem techniki balistokardiografii*” (Design and implementation of a ballistocardiographic heart rate monitor), Reader **J. Cichocki** (supervisor).
- [MSc25] Maciej Palmowski: „*Badania jakości dźwięku w urządzeniach audio wykorzystujących transmisję Bluetooth*” (Audio quality tests in Bluetooth audio devices), Assist. Prof. **P. Bobiński** (supervisor).
- [MSc26] Kinga Pękacka: „*Program do przetwarzania i klasyfikacji sygnałów elektrokardiograficznych*” (Program for processing and classification of electrocardiographic signal), Assist. Prof. **G. Domański** (supervisor).
- [MSc27] Izabela Plucińska: „*Rozproszone przetwarzanie danych proteomicznych w środowisku Apache Spark*” (Distributed processing of proteomic data in the Apache Spark environment), Assist. Prof. **T. Rubel** (supervisor).
- [MSc28] Małgorzata Pudlik: „*Optymalizacja procesu wytwarzania komorowej protezki ucha środkowego*” (Optimization of the chamber stapes prosthesis manufacturing process), Assoc. Prof. **M. Kwacz** (supervisor), M.Sc. degree with honours.
- [MSc29] Maciej Rosoł: „*Analiza przyczynowości sygnałów EMG z nielinowym jądrem modelowania*” (Causality analysis in EMG signals with nonlinear modeling kernels), Assist. Prof. **M. Młyńczak** (supervisor).
- [MSc30] Aneta Urszula Sankowska: “*Oprogramowanie do archiwizacji, wizualizacji i analizy medycznych obrazów scyntygraficznych*” (Software for archiving, visualization and analysis of medical scintigraphic images), Assoc. Prof. **W. Smolik** (supervisor).
- [MSc31] Dawid Smoleński: „*Program do symulacji wnikania światła w tkanki podczas usuwania blaszki miażdżycowej*” (Simulation of light penetration into tissues during the removal of atherosclerotic plaques), Assist. Prof. **G. Domański** (supervisor).
- [MSc32] Mateusz Szymon Socha: “*Zastosowanie obliczeń rozproszonych do identyfikacji białek w badaniach proteomicznych*” (Application of distributed computing in protein identification in proteomics), Assist. Prof. **T. Rubel** (supervisor).
- [MSc33] Joanna Sołowińska: “*Program do symulacji działania pulsoksymetru*” (Pulseoximeter simulation program), Assist. Prof. **G. Domański** (supervisor).
- [MSc34] Bartosz Sowul: “*Zastosowanie algorytmów genetycznych do budowy sieci U-Net do segmentacji obrazów medycznych*” (Application of genetic algorithms for building U-Net networks for medical image segmentation), Assist. Prof. **G. Protaziuk** (supervisor).
- [MSc35] Paulina Stefańczyk: „*Charakteryzacja elektryczna diod PiN w SiC i możliwości ich wykorzystania w inżynierii biomedycznej*” (Electrical characterization of PiN diodes in SiC and the possibilities of their application in biomedical engineering), Assist. Prof. **A. Werbowy** (supervisor).
- [MSc36] Bartosz Łukasz Stelmaszuk (Institute of Control and Computation Engineering): “*System inteligentny do rozpoznawania obiektów na zdjęciach*” (Intelligent system to recognise objects on pictures), Assoc. Prof. **P. Bilski** (supervisor).
- [MSc37] Rafał Tępiński: “*Symulacja kanału satelitarnego z wykorzystaniem techniki radia*

- programowalnego” (Simulation of a satellite channel with the usage of software-defined radio technique), Assist. Prof. **S. Kozłowski** (tutor).
- [MSc38] Magdalena Wiatr: “Aplikacja do wspólnej analizy sygnału oddechowego i EKG uwzględniająca domeny czasową, częstotliwościową, informacyjną i przyczynową” (Application for joint analysis of the respiratory and ECG signals, including time, frequency, information and causal domains), Assist. Prof. **M. Młyńczak** (supervisor).
- [MSc39] Marcin Marek Wiśniewski: “Wielostopniowy wzmacniacz mocy do radaru na pasmo L z tranzystorami GaN-on-Si” (Multistage high power amplifier for L-band radar with GaN-on-Si transistors), Assist. Prof. **D. Gryglewski** (supervisor).
- [MSc40] Julia Wójtowicz: “Rozpoznawanie cykli ektopowych w sygnale EKG metodą MPCa” (Recognition of ectopic cycles in the ECG signal using MPCa method), Assist. Prof. **J. Dusza** (supervisor).
- [MSc41] Katarzyna Woźna: “Rejestracja i analiza parametrów snu z wykorzystaniem radaru ultraszerokopasmowego” (Measurement and analysis of sleep parameters using an ultra-wideband radar), Reader **J. Cichocki** (supervisor).
- [MSc42] Aleksandra Zając: „System ekspertowy do diagnostyki weterynaryjnej” (Expert system for veterinary diagnostics), Assoc. Prof. **P. Biłski** (supervisor).
- [MSc43] Agnieszka Zalewska: „Przetwarzanie i analiza obrazów medycyny nuklearnej w otwartoźródłowym systemie Orthanc” (Processing and analysis of nuclear medicine images in the Orthanc open source system), Assoc. Prof. **W. Smolik** (supervisor).
- [MSc44] Adam Zarzecki: “Aplikacja serwerowa służąca do określania potencjału snu na podstawie zapisów z elektrokardiogramów” (The application server used to determine the sleep potential based on records from electrocardiograms), Assist. Prof. **A. Rychter** (supervisor).
- [BSc4] Natalia Błogosz: „Projekt ortez y z wykorzystaniem druku 3D przeznaczonej dla osób dotkniętych niedowładem dloni” (The use of 3D printing in the design of prostheses for people with hand paresis), Assist. Prof. **D. Jasińska-Choromańska** (supervisor).
- [BSc5] Krzysztof Bronikowski: „System ratunkowy GPS do lokalizacji rozbityków na morzu” (GPS rescue system for locating sea survivors), Assist. Prof. **A. Rychter** (supervisor).
- [BSc6] Piotr Chruściński: “Analiza neuroobrazowych badań populacyjnych na platformie Openstack” (Analysis of neuroimaging population research on the Openstack platform), Assist. Prof. **E. Piątkowska-Jankó** (supervisor).
- [BSc7] Dominik Cichal: „Projekt i realizacja mobilnej aplikacji dozometry hałasu” (Design and implementation of mobile noise dosimeter application), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc8] Kamil Cywoniu: „Szpitalny system informacyjny” (Hospital information system), Assist. Prof. **J. Kryszyn** (supervisor).
- [BSc9] Paweł Glegoła: „Implementacja cyfrowych filtrów Hilberta w środowisku MATLAB” (Implementation of digital filters using MATLAB), Assoc. Prof. **K. Snopek** (supervisor).
- [BSc10] Adam Goszkowski: „Baza danych przeznaczona do programu do doboru ochronników słuchu na urządzeniu mobilnym z systemem Android” (Database for a program used for selecting hearing protectors on an Android mobile device), Assist. Prof. **G. Makarewicz** (supervisor).
- [BSc11] Bartłomiej Góra: „Stanowisko do pomiaru poziomu dźwięku instrumentów muzycznych” (Stand for measuring the sound level of musical instruments), Assist. **A. Pietrzak** (supervisor).
- [BSc12] Mateusz Hryciów: „Algorytmy śledzenia ruchu osoby starszej w systemie monitoringu opartym na dwóch impulsowych czujnikach radarowych ultra-małej mocy” (Algorithms for tracking of elderly person in monitoring system based on two ultra-low-power impulse-radar sensors), Assist. Prof. **P. Mazurek** (supervisor).
- [BSc13] Dominika Jagieło: „Bezprzewodowe urządzenie do pomiaru fali pulsu” (Wireless device for pulse wave measurement), Assist. Prof. **G. Domański** (supervisor).
- [BSc14] Weronika Jakubczak: „Urządzenie do pomiaru sygnału EOG” (EOG measurement device), Assist. Prof. **G. Domański** (supervisor).
- [BSc15] Wojciech Janaszek: „Opracowanie filtra przepustowego na pasmo 24 GHz w technologii LTCC” (Development of a 24 GHz

5.3. B.Sc. Degrees

- [BSc1] Michał Bałut: „Internetowy katalog wizytówek” (Internet business card repository), Senior Lecturer **K. Ignasiak** (supervisor).
- [BSc2] Wojciech Bartosik: „Projekt i realizacja aplikacji webowej do tworzenia i przeprowadzania testów słuchowych MUSHRA” (Design and implementation of the web application for developing and conducting MUSHRA hearing tests), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc3] Mateusz Baryłka: „Oprogramowanie do wspomagania analizy jakości obrazów radiograficznych” (Software to support the analysis of radiographic image quality), Assist. Prof. **R. Kurjata** (supervisor).

- band pass filter in LTCC technology), Full Prof. **Y. Yashchyhyn** (supervisor).
- [BSc16] Renata Jankowska: „*Ocena poziomu dojrzałości systemów wspomagania kierowcy na przykładzie samochodu osobowego Ford Fiesta siódmej generacji*” (Assessment of the advancement level of driver assistance systems based on the example of a seventh generation Ford Fiesta passenger car), Full Prof. **A. Przelaskowski** (supervisor), Warsaw University of Technology Distant Learning Center (Ośrodek Kształcenia na Odległość PW).
- [BSc17] Bartłomiej Jerzy: „*Zautomatyzowany system oświetleniowy do akwarium oparty na diodach LED*” (Automated lighting system for aquarium based on LED diodes), Full Prof. **A. Przelaskowski** (supervisor), Warsaw University of Technology Distant Learning Center (Ośrodek Kształcenia na Odległość PW).
- [BSc18] Jakub Jurek: „*Optymalizacja sterowania kuchenki mikrofalowej poprzez rozpoznanie grzanego obiektu metodami uczenia maszynowego*” (Optimizing microwave oven control by recognizing the heated object by machine learning), Senior Lecturer **M. Sypniewski** (supervisor).
- [BSc19] Natalia Jurkiewicz: „*Analiza właściwości dynamicznych kręgosłupa pod wpływem obciążzeń*” (Analysis of spinal dynamic properties under load), Assist. Prof. **Z. Wawrzyniak** (supervisor).
- [BSc20] Olga Kalinowska: „*Application for raster image vectorization*” (Aplikacja do wektoryzacji obrazów rastrowych), Assist. Prof. **G. Galiński** (supervisor), B.Sc. degree with honours.
- [BSc21] Lizaveta Klimovich: „*Automatyczne wyznaczanie parametrów medycznych ze zdjęć obrazowania medycznego*” (Automated medical feature extraction from medical imaging), Full Prof. **J. Mulawka** (supervisor).
- [BSc22] Piotr Kociuba: „*Opracowanie oprogramowania do wizualizacji danych z modułów radarów ultraszerokopasmowych serii Xe-Thru*” (Software for data visualization from XeThru ultra-wideband radar modules), Reader **J. Cichocki** (supervisor).
- [BSc23] Jakub Kocot: „*Projekt i implementacja wtyczki VST do przestrzennego rozmieszczenia źródeł w scenie dźwiękowej*” (Design and implementation of the VST plugin for spatial placement of sound sources in the soundstage), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc24] Ewelina Kolpa: „*Zdarzeniowy rejestrator EKG z interfejsem Bluetooth*” (Event ECG recorder with Bluetooth interface), Assist. Prof. **R. Kurjata** (supervisor), B.Sc. degree with honours.
- [BSc25] Michał Konefał: „*Opracowanie algorytmów oceny aktywności oddechowej z analizy linii bazowej EKG oraz amplitudy załamków R*” (Development of algorithms for assessing respiratory activity from ECG baseline wander and R peak amplitude analysis), Assist. Prof. **M. Młyńczak** (supervisor).
- [BSc26] Michał Kowalczyk / Michał Tomaszewski: „*Wspomaganie diagnostyki obrazowej jaskry metodami uczenia maszynowego*” (Computer-aided glaucoma diagnosis using machine learning methods), Assist. Prof. **Z. Wawrzyniak** (supervisor).
- [BSc27] Natalia Kozak: „*Opracowanie metodą Monte-Carlo przesłony do dwuenergetycznej kontroli pojazdu*” (Development of shutter for dual - energy vehicle control using Monte-Carlo Method), Assoc. Prof. **S. Wronka** (supervisor).
- [BSc28] Patryk Krajewski: „*Wyznaczenie rekombinacyjnego wskaźnika jakości promieniowania w wiązkach aparatu RTG*” (Determination of recombination index of radiation quality in X-ray beams), Assoc. Prof. **P. Tulik** (supervisor).
- [BSc29] Filip Kraszewski: „*Wzmacniacz słuchawkowy Bluetooth*” (Bluetooth headphone amplifier), Assist. Prof. **M. Ziembicki** (supervisor).
- [BSc30] Jakub Krzysztof Kwietko: „*Program do analizy widm spektrometrycznych*” (Spectrum analysis software), Assist. Prof. **B. Konarzewski** (supervisor).
- [BSc31] Gabriela Kukwa: „*Oprogramowanie do wizualizacji widm mas próbek biologicznych*” (Program for visualization the mass specters of biological samples), Assist. Prof. **T. Rubel** (supervisor).
- [BSc32] Emilia Kurach: „*Gra animacyjna 3D z elementami oceny skutków narażeń elektromagnetycznych*” (3D animation game with elements of electromagnetic exposure rating), Senior Lecturer **M. Sypniewski** (supervisor), details of this thesis cannot be published without permission of WUT.
- [BSc33] Jakub Lewandowski: „*Moduł do stabilizacji temperatury detektorów SiPM z łączem Ethernet*” (Module for temperature stabilization of SiPM detectors with Ethernet connection), Assist. Prof. **A. Rychter** (supervisor).
- [BSc34] Piotr Limanowski: „*Inteligentny system wspomagający pracę inwestora giełdowego*” (An intelligent system supporting the work of a stock market investor), Assoc. Prof. **P. Biłski** (supervisor).
- [BSc35] Piotr Lorens: „*Moduł do pomiaru pola magnetycznego przeznaczony dla stanowiska do charakteryzacji fotopowielaczy*” (Magnetic field measurement module designed for the station to the photomultiplier characterization), Assist. Prof. **M. Ziembicki** (supervisor).

- [BSc36] Marcin Maciejewski: "Implementacja algorytmów cyfrowego przetwarzania sygnałów dla radiotelefonu analogowego wykonanego w technice Radia Programowego" (Implementation of digital signal processing algorithms for an analog radiotelephone made using Software Defined Radio concept), Assist. Prof. **P. Korpas** (supervisor), B.Sc. degree with honours.
- [BSc37] Jakub Magier: "Zdalna obsługa radiostacji" (Remote control of the radiostation), Assist. Prof. **D. Rosołowski** (supervisor).
- [BSc38] Dagmara Mazur: "Wykorzystanie cech radionomicznych zdjęć tomograficznych przy wykrywaniu guzów wątroby typu HCC" (Using tomographic images radiomics qualities in HCC liver tumor diagnosis), Full Prof. **J. Mulawka** (supervisor).
- [BSc39] Barbara Mirska: "Jednokanałowy wzmacniacz EKG ze sprzężeniem zmiennoprądowym" (Single channel AC-coupled amplifier for ECG), Assist. Prof. **G. Domąski** (supervisor), B.Sc. degree with honours..
- [BSc40] Jakub Murawski: "Implementacja wybranego algorytmu przetwarzania sygnałów fonycznych w technologii VST 3.0" (Implementation of the selected algorithm for processing audio signals in VST 3.0 technology), Assist. Prof. **M. Lewandowski** (supervisor).
- [BSc41] Weronika Niemirska: "Przeglądarka obrazów medycyny nuklearnej w standardzie DICOM" (Nuclear medicine image viewer in the DICOM standard), Assist. Prof. **J. Kryszyn** (supervisor).
- [BSc42] Katarzyna Olczak: "Pomiar stężenia izotopu radonu Rn-222 w próbkach ciekłych w zależności od metod przechowywania" (Measurements of radon-222 concentration in liquid samples depends on different storage methods), Assoc. Prof. **P. Tulik** (supervisor).
- [BSc43] Karol Piechal: "Interfejs webowy obsługi wybranych funkcji mikrofalowego źródła dużej mocy" (Web-based user interface of a high power microwave source), Assist. Prof. **P. Korpas** (supervisor).
- [BSc44] Michał Papiewski: "Zdarzeniowy rejestrator sygnału EKG z interfejsem Bluetooth" (ECG event recorder with the Bluetooth interface), Assist. Prof. **R. Kurjata** (supervisor).
- [BSc45] Jakub Pietrowciew: "Program symulacji rozchodzenia się fal elektromagnetycznych dla wybranych scenariuszy w środowisku mobilnym iOS, Android. Pomoc dydaktyczna dla studentów przedmiotów EPHY2 i POFA" (Mobile application for simulation of electromagnetic waves propagation in selected scenarios. Implemented on iOS and Android), Senior Lecturer **M. Sypniewski** (supervisor).
- [BSc46] Damian Purwin: "Aplikacja mobilna do prezentacji danych z systemu indeksowania obrazów" (Mobile application for the data presentation from the image indexing system), Assist. Prof. **A. Buchowicz** (supervisor), B.Sc. degree with honours.
- [BSc47] Maciej Radzimirski: "Pomiary w badaniach psychometrycznych" (Measurements of measurands in psychometric examinations), Assist. Prof. **J. Možaryn** (supervisor).
- [BSc48] Tomasz Rejmer: "Program symulacyjny do modelowania pomiarów z wykorzystaniem rentgenowskiej analizy fluorescencyjnej (RAF)" (Simulation program for modeling measurement with the use of X-ray fluorescence analysis), Assist. Prof. **B. Konarzewski** (supervisor).
- [BSc49] Julia Katarzyna Rzeczyca: "Pomiar i analiza składowej rzeczywistej i urojonej po-datności magnetycznej nanocząstek superparamagnetycznych" (Measurement and analysis of the real and imaginary component of the magnetic susceptibility of the superparamagnetic nanoparticles), Assoc. Prof. **W. Smolik** (supervisor).
- [BSc50] Szymon Sawicki: "Projekt i realizacja rozproszonego systemu monitoringu wizyjnego w sieci lokalnej" (Desing and implementation of a distributed video monitoring system in a local network), Asist. Prof. **G. Galiński** (supervisor).
- [BSc51] Wojciech Sobczak: "System identyfikacji różnic w fotografowanych scenach" (System for identifying differences in photographed scenes), Senior Lecturer **K. Ignasiak** (supervisor).
- [BSc52] Oskar Sołoń: "Projekt i implementacja efektu harmonizera w technologii wtyczek VST" (Project and implementation of harmonizer effect in VST technology), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc53] Wojciech Starek: "Projekt i realizacja audiometru w oparciu o mikrokontrolery z rodziną STM32" (Design and implementation of the audiometer based on microcontrollers from the STM 32 family), Assist. Prof. **G. Makarewicz** (supervisor).
- [BSc54] Wojciech Stasiak: „System edycji informacji udostępnianej w formie wiki” (Information editing system in the form of wiki), Senior Lecturer **K. Ignasiak** (supervisor).
- [BSc55] Piotr Sus: "Opracowanie metody do zarządzania urządzeniami gospodarstwa domowego przy użyciu analizy sygnału EEG z wykorzystaniem potencjałów wywołanych P300" (Development of the method to manage household appliances using EEG signal analysis with P300 evoked potentials), Assist. Prof. **M. Młyńczak** (supervisor).
- [BSc56] Natalia Szakiel: "Oprogramowanie do analizy parametrów pracy stacji bazowej" (oftware for the analysis of base station oper-

- ating parameters), Assist. **V. Djaja-Joško** (supervisor).
- [BSc57] Michał Świątek: „*Przeglądarka obrazów scyntygraficznych*” (Image viewer for scintigraphy), Assoc. Prof. **W. Smolik** (supervisor).
- [BSc58] Aleksandra Szcześniak: „*Analiza dyskryminacyjna widm spektroskopii rezonansu magnetycznego guzów mózgu*” (Discriminant analysis of magnetic resonance spectroscopy spectra of brain tumors), Assoc. Prof. **P. Bogorodzki** (supervisor), B.Sc. degree with honours.
- [BSc59] Mateusz Tarasiuk: „*Projekt i realizacja urządzenia do rejestracji niskich częstotliwości (subkick)*” (Design and implementation of a low frequency recording device (subkick), Assist. Prof. **M. Lewandowski** (supervisor).
- [BSc60] Artur Paweł Tkaczyk (the Institute of Informatics, WUT): „*Kodek obrazu wykorzystujący Asymetryczny System Numeryczny*” (Image codec using Asymmetric Numeral Systems), Assoc. Prof. **G. Pastuszak** (supervisor).
- [BSc61] Maciej Michał Tomaszewski: „*Wspomaganie diagnostyki obrazowej jaskry metodami uczenia maszynowego*” (Computer-aided glaucoma diagnosis using machine learning methods), Assist. Prof. **Z. Wawryniak** (supervisor).
- [BSc62] Paulina Weronika Wieczorek: „*Detekcja twarzy z wykorzystaniem splotowych sieci neuronowych*” (Face detection using convolutional neural networks), Assist. Prof. **G. Galiński** (supervisor).
- [BSc63] Adrian Witan: „*Aplikacja do obsługi kamery monitoringu wizyjnego*” (Video monitoring camera application), Assist. Prof. **A. Buchowicz** (supervisor).
- [BSc64] Sylwia Wróbel: „*Oprogramowanie wspomagające badania materiałów ferroelektrycznych*” (Software supporting ferroelectric materials measurements), Assist. Prof. **K. Godziszewski** (supervisor).
- [BSc65] Anton Zinchenko: „*Krótkokresowa predykcja mocy generowanej przez turbiny wiatrowe*” (Project of short-term wind power prediction), Assoc. Prof. **P. Bilski** (supervisor).
- [BSc66] Aleksandra Zioło: „*Aplikacja mobilna dzienniczek diabetyka*” (Mobile application diabetic's diary), Assist. Prof. **R. Kurjata** (supervisor).

5.4. B.Sc. Evening Studies on Radio-communications – B.Sc. Degrees

- [BSc67] Daniel Kamiński: „*Aplikacja multimedialnej stacji pogodowej*” (Multimedia application of the weather station), Senior Lecturer **K. Ignasiak** (supervisor).
- [BSc68] Natalia Joanna Książek: „*Internetowy odtwarzacz plików multimedialnych*” (Web multimedia player), Assist. Prof. **W. Kazubski** (supervisor)

6. PUBLICATIONS

6.1. Scientific and technical books, chapters in books

- [Pub1] P. Bogorodzki, E. Piątkowska-Janko, W. Obrebski, M. Krzewski: „Czynnościowy rezonans magnetyczny (fMRI) w badaniach rehabilitacji pourazowej” (Functional Magnetic Resonance Imaging (fMRI) in Post-Traumatic Rehabilitation Studies), in: *Inżynieria Biomedyczna Podstawy i Zastosowania*, W. Torbicz (ed.), *Obrazowanie Biomedyczne*, A. Nowakowski, M. Kaczmarek, L. Królicki, J. L. Kulikowski (eds.), vol. 8, *Akademicka Oficyna Wydawnicza EXIT*, 2020, ISBN 978-83-7837-087-1.
- [Pub2] K. Snopek: “Complex and Hypercomplex Multidimensional Analytic Signals – Theory and Chosen Properties”, in: *Advances in Signal Processing: Reviews* , S. Y. Yurish (ed.), *IFSA Publishing*, vol. 2, 2020, ISBN: 978-84-09-04329-3.

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 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 (...), R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (384 external authors): „Measurement of the Muon Neutrino Charged-Current Single π^+ Production on Hydrocarbon Using the T2K Off-Axis Near Detector ND280”, *Physical Review D*, vol. 101, 2020, pp. 012007-1-012007-19.
- [Pub4] K. Abe, (...), R. Kurjata, A. Rychter, M. Ziembicki, K. Zaremba (299 external authors): „Constraint on the Matter-Antimatter Symmetry-Violating Phase in Neutrino Oscillations”, *Nature*, vol. 580, 2020, pp. 339-344.
- [Pub5] K. Abe (...), R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (364 external authors): „First Combined Measurement of the Muon Neutrino and Antineutrino Charged-Current Cross Section without Pions in the Final State at T2K”, *Physical Review D*, vol. 101, 2020, pp. 112001-1-112001-44.
- [Pub6] K. Abe (...), R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (331 external authors): „Simultaneous Measurement of the Muon Neutrino Charged-Current Cross Section on Oxygen and Carbon without Pions in the Final State at T2K”, *Physical Re-*

- view D*, vol. 101, 2020, pp. 112004-1-112004-32.
- [Pub7] K. Abe (...), R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (331 external authors): “Search for Electron Antineutrino Appearance in a Long-Baseline Muon Antineutrino Beam”, *Physical Review Letters*, vol. 124, 2020, pp. 161802-1-161802-8.
- [Pub8] K. Abe (...), R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (391 external authors): “First Measurement of the Charged Current $\bar{\nu}_\mu$ Double Differential Cross Section on a Water Target without Pions in the Final State”, *Physical Review D*, vol. 102, 2020, pp. 012007-1-012007-16.
- [Pub9] K. Abe (...), R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (368 external authors): “Measurement of the Charged-Current Electron (Anti-) Neutrino Inclusive Cross-Sections at the T2K Off-Axis Near Detector ND280”, *Journal of High Energy Physics*, 2020, article no. 114.
- [Pub10] C. Adolph (...), R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (265 external authors): “Erratum to: Azimuthal Asymmetries of Charged Hadrons Produced in High-Energy Muon Scattering off Longitudinally Polarised Deuterons”, *The European Physical Journal C*, vol. 80, no. 298, pp. 297-299.
- [Pub11] J. Agarwala (...), R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (207 external authors): „Contribution of Exclusive Diffractive Processes to the Measured Azimuthal Asymmetries in SIDIS”, *Nuclear Physics B*, vol. 956, 2020, article no. 115039, 14 pp.
- [Pub12] G. D. Alexeev (...), R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (183 external authors): „Antiproton over Proton and K^- over K^+ Multiplicity Ratios at High z in DIS”, *Physics Letters B*, vol. 807, 2020, article no. 135600, doi: 10.1016/j.physletb.-2020.135600, 10 pp.
- [Pub13] M. G. Alexeev (...), R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (187 external authors): „Measurement of the Cross Section for the Hard Exclusive π^0 Muoproduction on the Proton”, *Physics Letters B*, vol. 805, 2020, 8 pp.
- [Pub14] D. Attié, M. Batkiewicz-Kwaśniak, J. Boix, S. Bolognesi, S. Bordoni, D. Calvet, M. G. Catanesi, R. Kurjata, A. Rychter, M. Ziembicki: “Performances of a Resistive Micromegas Module for the Time Projection Chambers of the T2K Near Detector Upgrade”, *Nuclear Instruments & Methods in Physics Research Section A Accelerators, Spectrometers, Detectors and Associated Equipment*, Elsevier, vol. 957, 2020, doi:10.1016/j.nima.2019.163286, pp. 1-19.

- [Pub15] Z. Barani, F. Kargar, K. Godziszewski, A. Rehman, Y. Yashchyn, S. Rumyantsev, G. Cywiński, W. Knap, A. A. Balandi: "Graphene Epoxy-Based Composites as Efficient Electromagnetic Absorbers in the Extremely High-Frequency Band", *ACS Applied Materials & Interfaces*, vol. 12, no. 25, 2020, pp. 2835-2864.
- [Pub16] P. Bilski: "Analysis of the Ensemble of Regression Algorithms for the Analog Circuit Parametric Identification", *Measurement*, vol. 160, 2020, doi.org/10.1016/j.measurement.2020.107829, 9 pp.
- [Pub17] G. Bogdan, K. Godziszewski, Y. Yashchyn: „Time-Modulated Antenna Array with Beam-Steering for Low-Power Wide-Area Network Receivers”, *IEEE Antennas and Wireless Propagation Letters*, vol. 19, no. 11, 2020, doi: 10.1109/LAWP.2020.-3007925, pp. 1876-1880.
- [Pub18] G. Bogdan, K. Godziszewski, Y. Yashchyn, C. H. Kim and S.B. Hyun: "Time-Modulated Antenna Array for Real-Time Adaptation in Wideband Wireless Systems-Part I: Design and Characterization," *IEEE Transactions on Antennas and Propagation*, vol. 68, no. 10, Oct. 2020, doi: 10.1109/TAP.2019.2902755 pp. 6964-6972.
- [Pub19] G. Bogdan, K. Godziszewski, Y. Yashchyn: „Time-Modulated Antenna Array for Real-Time Adaptation in Wideband Wireless Systems – Part II: Adaptation Study”, *IEEE Transactions on Antennas and Propagation*, vol. 68, no. 10, 2020, doi: 10.1109/TAP.2020.3008633, pp. 6973-6981.
- [Pub20] G. Bogdan, P. Bajurko, Y. Yashchyn: "Time-Modulated Antenna Array with Dual-Circular Polarization", *IEEE Antennas and Wireless Propagation Letters*, vol. 19, no. 11, 2020, doi: 10.1109/LAWP.2020.-2999643, pp. 1872-1875
- [Pub21] G. Bogdan, K. Godziszewski, Y. Yashchyn: "Experimental Investigation of Beam-Steering Applied to 2x2 MIMO System with Single Receiving RF Chain and Time-Modulated Antenna Array", *International Journal of Microwave and Wireless Technologies*, vol. 12, no. 6, 2020, pp. 504-512.
- [Pub22] M. Fiedorowicz, M. I. Khan, D. Strzemecki, J. Orzeł, M. Wełniak-Kamińska, A. Sobiborowicz, M. Wieteska, Z. Rogulski, L. Cheda, W. Wargocka-Matuszewska, K. Kilian, C. Szczylk, A. M. Czarnecka: "Renal Carcinoma CD105-/CD44-cells Display Stem-like Properties *in vitro* and Form Aggressive Tumors *in vivo*", *Scientific Reports*, no. 10, 2020, article no. 5379, 19 pp.
- [Pub23] M. Fiedorowicz, M. Wełniak-Kamińska, M. Świątkiewicz, J. Orzeł, T. Chorągiewicz, M. D. Toro, R. Rejdak, P. Bogorodzki, P. Grieb: „Changes of Ocular Dimensions as a Marker of Disease Progression in a Murine Model of Pigmentary Glaucoma”, *Frontiers in Pharmacology*, vol. 11, article no. 573238, doi: 10.3389/fphar.2020.573238, 2020, 15 pp.
- [Pub24] I. P. Grudziński, M. Bystrzejewski, P. Bogorodzki, A. Cieszanowski, W. Szczękowski, M. Popławska, M. Bamburowicz-Klimkowska: „Comprehensive Magnetic Resonance Characteristics of Carbon-Encapsulated Iron Nanoparticles: a New Frontier for the Core-Shell-Type Contrast Agent”, *Journal of Nanoparticle Research*, vol. 22, no. 82, 2020, 17 pp.
- [Pub25] I. V. Horbatyi, Y. Yashchyn: "Modernization of DVB-S2 Standard Using Signal-Code Constructions Based on Amplitude Modulation of Many Components", *International Journal of Electronics and Telecommunications*, vol. 66, no. 2, 2020, doi: 10.2445/ijet.2020.131880/698, pp. 315-320.
- [Pub26] J. Kołakowski, V. Djaja-Joško, M. Kołakowski, K. Broczek: "UWB/BLE Tracking System for Elderly People Monitoring, Sensors", vol. 6, nr 20, 2020, article no. 1574, pp. 1-22.
- [Pub27] J. Kołakowski, V. Djaja-Joško, M. Kołakowski, J. Cichocki: "Localization System Supporting People with Cognitive Impairment and Their Caregivers", *International Journal of Electronics and Telecommunications*, vol. 66, no. 1, 2020, pp. 125-131.
- [Pub28] M. Kołakowski: "Automatic Radio Map Creation in a Fingerprinting-based BLE/UWB Localisation System", *IET Microwaves, Antennas & Propagation*, vol. 14, issue 14, 2020 doi: 10.1049/iet.map.-2019.0953, pp. 1758-1765.
- [Pub29] M. Kołakowski, V. Djaja-Joško, J. Kołakowski: „Static LiDAR Assisted UWB Anchor Nodes Localization”, *IEEE Sensors Journal*, 2020, doi: 10.1109/JSEN.2020.-3046306, published online.
- [Pub30] T. Kosilo, K. Radecki, J. Marski, C. Górska: „Mobile IoT Systems in the Urban Area”, *International Journal of Electronics and Telecommunications*, vol. 66, no. 1, 2020, doi: 10.2445/ijet.2020.131861, pp. 179-185.
- [Pub31] A. Krajewski, P. Bilski, P. Witomski, P. Bobiński, J. Guz: „The Progress in the Research of AE Detection Method of Old House Borer Larvae (*Hylotrupes bajulus L.*) in Wooden Structures”, *Construction and Building Materials*, vol. 256, 2020, 7 pp.
- [Pub32] J. Krupka, A. Pacewicz, B. Salski, P. Kopyt: „Electrodynamic Theory of Ferromagnetic Resonance and its Applications in Precise Measurements of Ferromagnetic Linewidth, Permeability Tensor and Saturation Magnetization”, *AIP Advances*, 64th Annual Conference on Magnetism and Magnetic Materials (MMM) (Las Vegas, USA, Nov. 4-8, 2019), vol. 10, issue 1, article no. 015018, published Jan. 2020, 7 pp.

PUBLICATIONS

- [Pub33] J. Krupka, A. Pacewicz, B. Salski, P. Kopyt, J. Bourhill, M. Goryachev, M. Tobar: „Resonance in Large Ferrimagnetic YIP Samples – Electrodynamic Analysis”, *Journal of Magnetism and Magnetic Materials*, 2020, article no. 167536, in press.
- [Pub34] D. Kuchta, D. Gryglewski, W. Wojtasik: „A GaN HEMT Amplifier Design for Phased Array Radars and 5G New Radios”, *Micromachines*, vol. 11, no. 4, 2020, <https://doi.org/10.3390/mi11040398>, article no.398, pp. 1-13.
- [Pub35] K. Kuczyński, A. Bilski, P. Bilski, J. Szymbański: „Analysis of the Magneto-electric Sensor's Usability for the Energy Harvesting”, *International Journal of Electronics and Telecommunications*, vol. 66, no. 4, 2020, doi: 10.24425/ijet.2020.-135193, pp. 787-792
- [Pub36] P. Mazurek, J. Wagner, A. Miękina, R. Z. Morawski: „Comparison of Sixteen Methods for Fusion of Data from Impulse-Radar Sensors and Depth Sensors Applied for Monitoring of Elderly Persons”, *Measurement*, vol. 154, 2020, paper #107455, pp. 1-25.
- [Pub37] R. Z. Morawski: „Measurement in the Context of Technoscientific Research”, *tm-Technisches Messen*, published online: Oct. 2019, vol. 87, issue 4, 2020, pp. 294-301.
- [Pub38] M. Mikołajewski: „Output Voltage Control in the Class E ZVS Inverter by Frequency or Reactance Regulation”, *Przegląd Elektrotechniczny*, vol. 96, no. 9, 2020, pp. 8-15.
- [Pub39] T. A. Miś: „Efficiency Calculation and Comparison of Fluidic and Solid-Body Power Sources Using Corpuscular Radiation” *Nukleonika*, vol. 65, issue 1, 2020, doi: 10.2478/nuka-2020-0004, pp. 31-35.
- [Pub40] T. A. Miś, J. Modelska: „The Analysis of experimental Deployment of IGLUNA 2019 Trans-Ice Longwave System”, *Remote Sensing*, vol. 12, no. 45, 2020, article no. 4045, 17 pp.
- [Pub41] M. Nurgaliyev, A. Saymbetov, Y. Yashchyn, N. Kuttybay, D. Tukymbekov: „Prediction of Energy Consumption for LoRa Based Wireless Sensors Network”, *Wireless Networks*, 2020, 14 pp.
- [Pub42] A. Pacewicz, J. Krupka, P. Aleshkevych, B. Salski, P. Kopyt, R. Frender: „Broad-Ferromagnetic-Linewidth Non-Metallic Gyromagnetic Spheres: a Comparison of Linewidth Characterization Methods”, *Journal of Applied Physics*, vol. 127, issue 16, 2020, article no. 163903, doi: 10.10635.-0004027, 13 pp.
- [Pub43] G. Pastuszak: „Generative Multi-Symbol Architecture of the Binary Arithmetic Coder for UHDTV Video Encoders”, *IEEE Transactions on Circuits and Systems -I-Regular Papers*, vol. 67, issue 3, 2020, pp. 891-902.
- [Pub44] G. Pastuszak: „Multisymbol Architecture of the Entropy Coder for H.265/HEVC Video Encoders”, *IEEE Transactions on Very Large Scale Integration (VLSI) Systems*, vol. 28, issue 12, 2020, pp. 2573-2583.
- [Pub45] B. Salski, P. Czeała, J. Cuper, P. Kopyt, H. Jeon, W. Yang: „Electromagnetic Modeling of Radiowave Propagation and Scattering from Targets in the Atmosphere with a Ray Tracing Technique,” *IEEE Transactions on Antennas and Propagation*, early access, 2020.
- [Pub46] B. Salski, T. Karpisz, P. Kopyt, J. Krupka: „Rigorous Scattering Matrix Analysis of a Fabry-Perot Open Resonator”, *IEEE Transactions on Microwave Theory and Techniques*, early access, 2020.
- [Pub47] B. Sojewska, Y. Yashchyn: „Design of Millimeter-Wave Six-Port Device for LTCC Technology”, *International Journal of Electronics and Telecommunications*, vol. 66, no. 1, 2020, pp. 33-40.
- [Pub48] B. Synkiewicz-Musialska, D. Szwagierczak, J. Kulawik, N. Pałka, P. R. Bajurko: „Impact of Additives and Processing on Microstructure and Dielectric Properties of Willemite Ceramics for LTCC Terahertz Applications”, *Journal of the European Ceramic Society*, vol. 40, no. 2, 2020, pp. 362-370.
- [Pub49] D. Szwagierczak, B. Synkiewicz-Musialska, J. Kulawik, E. Czerwińska, N. Pałka, P. Bajurko: „Low Temperature Sintering of Zn4B6O13 based Substrates, their Microstructure and Dielectric Properties up to the THz Range”, *Journal of Alloys and Compounds*, vol. 819, no. 5, 2020, article no. 153025, 11 pp.
- [Pub50] M. Wakula, A. Balcerak, T. Rubel, M. Chmielarczyk, R. Konopiński, F. Łyczek, E. A. Grzybowska: „The Interactome of Multifunctional HAX1 Protein Suggests its Role in the Regulation of Energy Metabolism, De-Aggregation, Cytoskeleton Organization and RNA-Processing”, *Bioscience Reports*, vol. 4, no. 11, 2020, 43 pp.
- [Pub51] Ch. Wu, S. Lu, Z. Yang, Y. Yashchyn: „A UWB Absorber Based on the TCA Concept in the UHF Band”, *IEEE Transactions on Antennas and Propagation*, vol. 68, no. 5, 2020, pp. 4132-4136.
- [Pub52] Ch. Wu, Y. Liu, S. Lu, S. Gruszczyński, Y. Yashchyn: „Convenient Waveguide Technique for Determining Permittivity and Preability of Materials”, *IEEE Transactions on Microwave Theory and Techniques*, vol. 68, issue 1, 2020, doi: 10.1109/TMTT.-2020.3009995, pp. 4905-4912.
- [Pub53] Ch. Wu, C. Li, Ch. Hu, Y. Yashchyn: „Dual-Polarization and Low-Sidelob Corrugated Rectangular Horn Antennas for Outdoor RCS Measurement”, *Frequenz*, vol. 74, issue 1-2, 2020, doi: 10.1515/freq-2019-0039, pp. 33-40.

- [Pub54] P. Zradziński, J.Karpowicz, K. Gryz, L. Morzyński, R. Młyński, A. Świdziński, K. Godziszewski, V. Ramos: „Modelling the Influence of Electromagnetic Field on the User of a Wearable IoT Device Used in a WSN for Monitoring and Reducing Hazards in the Work Environment”, *Sensors*, vol. 20, no. 24, 2020, article no. 7131.

6.2.2. Other journals

This subsection contains papers in the journals not indicated on the list of the Ministry of Science and Higher Education

- [Pub55] G. Bogdan, Y. Yashchyshyn: „Adaptacyjne kształtowanie charakterystyki kierunkowej anteny z modulacją czasową” (Adaptive Beamforming in a Time-Modulated Antenna Array), *Przegląd Telekomunikacyjny- Wiadomości Telekomunikacyjne*, vol. 2020, no. 7-8, 2020, doi: 10.15199/59.2020.7-8.46, pp. 342-345.

- [Pub56] M. Kołakowski: „Redukcja wpływu ciała użytkownika na dokładność lokalizacji z wykorzystaniem hybrydowego algorytmu lokalizacyjnego” (Mitigation of Users's Body Impact on Localization Accuracy Using a Hybrid Positioning Algorithm), *Przegląd Telekomunikacyjny- Wiadomości Telekomunikacyjne*, vol. 2020, no. 7-8, 2020, doi: 10.15199/59.2020.7-8.39.

- [Pub57] T. Kosiło: “System mobilny 5G” (5G Mobile System), *Elektroinstalator*, no. 2, 2020, pp. 18-19.

- [Pub58] T. Kosiło: “System mobilny 5G” (5G Mobile System), *Elektronika – Konstrukcje – Technologie – Zastosowania*, vol. 61, no. 1, 2020, pp. 15-22.

- [Pub59] T. A. Miś: “Projekt i analiza termiczna wzmacniacza mocy POWER MOSFET dla specjalnych systemów nadawczych w zakresie fal długich i bardzo długich” (Design and Thermal Analysis of POWER MOSFET Amplifier for LF and VLF Special Transmitting Systems), *Przegląd Telekomunikacyjny- Wiadomości Telekomunikacyjne*, vol. 2020, no. 7-8, 2020, doi: 10.15199/59.-2020.7-8.50.

- [Pub60] T. A. Miś: „Eksperimentalna tranzystoryzacja i antena zastępcza RCN Konstantynów” (Experimental Transistorization and Replacement Antenna of the Konstantynów LW Transmitter), *Przegląd Telekomunikacyjny- Wiadomości Telekomunikacyjne*, vol. 2020, no. 7-8, 2020, doi: 10.15199/59.2020.7-8.47.

- [Pub61] T. A. Miś: „Częstotliwościowo-dystrybucyjna analiza szumów w radiofonicznym paśmie fal długich” (Frequency-Distributive Analysis of Noise in the Longwave Radio Broadcasting Spectrum), *Przegląd Telekomunikacyjny- Wiadomości Telekomunikacyjne*, vol. 2020, no. 7-8, 2020, doi: 10.15199/59.2020.7-8.31.

- [Pub62] T. A. Miś: „Rejestracja i wstępna analiza sygnałów długofalowych ziemskich syste-

mów radiodyfuzyjnych w przestrzeni kosmicznej” (Registration and Preliminary Analysis of Terrestrial Longwave Radio Broadcasting Systems in Space), *Przegląd Telekomunikacyjny- Wiadomości Telekomunikacyjne*, vol. 2020, no. 7-8, 2020, doi: 10.15199/59.2020.7-8.15.

- [Pub63] P. Zradziński, J.Karpowicz, K. Gryz, L. Morzyński, R. Młyński, A. Świdziński, K. Godziszewski, V. Ramos: „Modelling the Influence of the 2.4 GHz Electromagnetic Field on the User of a Wearable Internet of Things (IoT) Device for Monitoring Hazards in the Work Environment”, *Engineering Proceedings*, vol. 2, no. 39, 2020, 7th Electronic Conference on Sensors and Applications (Beijing, China, Nov. 15-30, 2020), doi: 10.3390/ecsa-7-08238.

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

- [Pub64] K. M. Snopek, J. Jarkowski: „Wspomnienie o Profesorze Stefanie L. Hahnie” (Memory of Professor Stefan Lahn), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. LXXXIX, no. 9-10, 2020, pp. 412-413.

6.3. Scientific and technical papers in conference proceedings

Conference proceedings published in online subscription-based scientific citation index: Web of Science are indicated by *)

Publications [Pub72], [Pub90] have not been published in the Annual Report 2019

- [Pub65] N. Andrushchak, D. Vynnyk, Y. Yashchyshyn, V. Haiduchok, P. Bajurko, K. Godziszewski, A. Andrushchak: „Estimation of the Diffraction Efficiency of Oxide Single Crystals Acousto-Optic Devices in the Sub-Terahertz Frequency Range,” Proc. 2020 IEEE 15th International Conference on Advanced Trends in Radioelectronics, Telecommunications and Computer Engineering (TCSET), Lviv-Slavsk, Ukraine, 2020, pp. 829-833. *)

- [Pub66] P. Bajurko, K. Godziszewski, Y. Yashchyshyn, D. Vynnyk, V. Haiduchok, I. Solskii: „Determination of $\text{Bi}_{12}\text{SiO}_{20}$ Permittivity and Loss Tangent in the 220–325 GHz Band and the Influence of UV Exposure on these Parameters,” Proc. 2020 IEEE 15th International Conference on Advanced Trends in Radioelectronics, Telecommunications and Computer Engineering (TCSET), Lviv-Slavsk, Ukraine, 2020, pp. 576-579. *)

- [Pub67] P. R. Bajurko, J. Sobolewski, M. Widlok, K. Godziszewski, G. Bogdan, J. Marczewski, J. Kulawik: “A 110 GHz Hybrid Integrated Transmitter Design”, Proc. 23rd International Microwave and Radar Conference: MIKON 2020 (Warsaw, Poland, Oct. 5-8, 2020), pp. 367-370. *)

- [Pub68] G. Bogdan, Y. Yashchyshyn: “Adaptacyjne kształtowanie charakterystyki anteny z

- modulacja czasową" (Adaptive Beamforming in a Time Modulated Antenna Array), *Mat. XXVIth Krajowej Konferencji Radiokomunikacji, Radiofonii i Telewizji: KKRRIT 2020* (Proc. XXVIth National Conference on Radiocommunications and Broadcasting (Łódź, Poland, Sept. 17-18, 2020).
- [Pub69] M. Celuch, O. Douheret, P. Korpas, R. Michnowski, M. Olszewska-Placha, J. Rudnicki: "Portable Low-Cost Measurement Setup for 2D Imaging of Organic Semiconductors", *Proc. IEEE MTT-S International Microwave Symposium* (Los Angeles, USA, Aug. 4-6, 2020), pp. 1-4.*
- [Pub70] X. Chang, W. Skarbek: "Multimodal Emotion Classification by Streaming Fixed Time Segments for Speaker Movies", *Proc. SPIE Photonics Applications in Astronomy, Communications, Industry, and High Energy Physics Experiments*, vol. 11581, 2020, doi: 10.1117/12.2579932.*
- [Pub71] O. Cramariuc, I. Mocanu, K. Broczek, D. Krivec, J. Kołakowski, N. Samar Brencic, Z. Nagymáté, I. Nagy, A. Consoli: "What Can We Learn from an ICT Project Dedicated to People Living with Dementia", *Proc. 14th Int. Technology, Education and Development Conference INTED 2020*; (Valencia, Spain, 2-4 March, 2020); ISBN: 978-84-09-17939-8 / ISSN: 2340-1079, doi: 10.21125/inted.2020; Publisher: IATED.
- [Pub72] J. Cuper, M. Rytel, B. Salski, P. Kopyt: "A Ku-band Marchand's Balun for Active Doubler in a GaAs Process", *Proc. IEEE MTT-S International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization: NEMO* (Boston, USA, May 29-31, 2019), 4 pp.*
- [Pub73] J. Cuper, B. Salski, T. Karpisz, A. Pacewicz, P. Kopyt: "Conductivity Measurement in mm-wave Band with a Fabry-Perot Open Resonator", *Proc. 2020 IEEE/MTT-S International Microwave Symposium* (Los Angeles, USA, Aug. 4-6, 2020), pp. 996-998.*
- [Pub74] V. Djaja-Jośko: "Novel Method for the Wireless Synchronization of the Anchors in the UWB Localization System Utilizing Two Reference Nodes", *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 69-73.*
- [Pub75] V. Djaja-Jośko: "Nowa metoda bezprzewodowej synchronizacji w ultraszerokopasmowych systemach lokalizacyjnych wykorzystująca dwa węzły referencyjne" (Novel Method for the Wireless Synchronization in Ultrawideband Localization Systems Using Two Reference Nodes), *Mat. 21 Seminarium – Radiokomunikacja i Techniki Multimedialne* (Proc. 21st Seminar – Radiocommunications and Multimedia Technologies) (Warsaw, Poland, Dec. 09, 2020), pp. 57-62.
- [Pub76] K. Dowalla, R. Łukaszewski, A. Wójcik, M. Januszewski: „Adaptacja systemu pomiarowego i metoda przygotowania danych do badań algorytmów NIALM” (Adaptation of the Measurement System and Method of Data Preparation for Testing NIALM Algorithms), *Mat. XIII Konferencja Naukowa: Systemy Pomiarowe w Badaniach Naukowych i w Przemyśle* (Proc. XIIIth Scientific Conference: Measurement Systems in Research and Industry) (Zielona Góra, Poland. Jun. 14-17, 2020), pp. 29-44.
- [Pub77] K. Godziszewski, Y. Guo, Y. Yashchyshyn, F. Gao: "BST/PUDF Ferroelectric Composites at Microwave Frequencies", *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 95-98.*
- [Pub78] M. Góralczyk: "A 3.4 to 3.8 GHz 45 W Inverted 3-Way Doherty Power Amplifier", *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 420-423.
- [Pub79] D. Gryglewski, M. Wiśniewski, W. Wojtasik: "L-band High-Power GaN-on-Si HEMT Amplifier", *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 411-415.*
- [Pub80] D. Gryglewski, M. Wiśniewski, W. Wojtasik: „Wielostopniowy wzmacniacz mocy z tranzystorami GaN-on-Si HEMT dla modułu N/O radaru na pasmo L” (Multi-stage L-band Power GaN-on-Si HEMT Amplifier), *Mat. XIX Krajowej Konferencji Elektroniki: KKE 2020* ((XIXth National Conference on Electronics) (Darłowo, Poland, Aug. 30 – Sept. 2, 2020), pp. 138-145.
- [Pub81] T. Karpisz, B. Salski, J. Krupka, P. Kopyt: "Measurement of In-Plane Anisotropy of Dielectric Materials with a Fabry-Perot Open Resonator", *Proc. MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020).*
- [Pub82] J. Kołakowski: "A Method for TDOA Errors Mitigation in UWB Positioning System", *Proc. MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 148-151.*
- [Pub83] M. Kołakowski: "Redukcja wpływu ciała użytkownika na dokładność lokalizacji z wykorzystaniem hybrydowego algorytmu lokalizacyjnego" (Reduction of the Impact of the User's Body on the Accuracy of Localization Using a Hybrid Location Algorithm), *Mat. XXVIth Krajowej Konferencji Radiokomunikacji, Radiofonii i Telewizji: KKRRIT 2020* (Proc. XXVIth National Conference on Radiocommunications and Broadcasting (Łódź, Poland, Sept. 17-18, 2020).
- [Pub84] M. Kołakowski: "Comparison of Extended and Unscented Kalman Filters Performance in a Hybrid BLE-UWB Localization System", *Proc. 23rd International Microwave and Radar Conference: MIKON 2020*

- (Warsaw, Poland, Oct. 5-8, 2020), pp. 122-126.)
- [Pub85] P. Kopyt, J. Krupka, B. Salski: "Measurement of the Complex Anisotropic Permittivity of Microwave Laminates", *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 114-117.
- [Pub86] P. Kopyt, B. Salski: „VNA Replacements to be Used in Measurements of Material Properties Performed in the mm-wave and sub-THz Bands”, *Proc. Electronic Materials and Applications: EMA 2020* (Orlando, USA, Jan. 22-24, 2020).
- [Pub87] M. Krysicki, B. Salski: Hybrid Electromagnetic Modelling of Coherent Radiation in Electrically-pumped Semiconductor Lasers”, *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020).)
- [Pub88] M. Łucjan: “Węzeł rozproszonego systemu IoT do monitorowania parametrów środowiskowych” (Node of a Distributed IoT System for Environmental Parameters Monitoring), *Mat. 21 Seminarium – Radiokomunikacja i Techniki Multimedialne* (Proc. 21st Seminar – Radiocommunications and Multimedia Technologies) (Warsaw, Poland, Dec. 09, 2020), pp. 21-28.
- [Pub89] G. Makarewicz, P. Bilski: “Diagnostics of the RIAA Equalizer in a Turntable Using Artificial Neural Network”, *Proc. 17th IMEKO TC 10 and EUROLAB Virtual Conference “Global Trends in Testing Diagnostics & Inspection for 2030”* (Zagreb, Croatia, Oct. 20-22, 2020), pp. 190-195.
- [Pub90] A. Masłowski, T. A. Miś, D. Grabowski, M. Owczarzak, J. Wajoras, E. Żak, M. Surma, J. Wiśniewska: “BEXUS27 LUSTRO – Design and Test of the Light and Ultraviolet Strato- and Tropospheric Radiation Observer”, *Proc. 24th ESA Symposium on European Rocket and Balloon Programmes and Related Research* (Essen, Germany, Jun. 16-20, 2019), pp. 137-144.
- [Pub91] P. Mazurek: “Applicability of Multiple Impulse-Radar Sensors for Estimation of Person’s Three-Dimensional Position”, *Proc. 2020 IEEE International Instrumentation and Measurement Technology Conference: I2MTC* (Dubrovnik, Croatia, May 25-28, 2020), doi: 10.1109/I2MTC43012.-2020.9128760.
- [Pub92] M. Mikołajewski: “A Class E ZVS Amplifier with Basic Matching Circuits”, *Proc. Second Baltic URSI 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 77-80.
- [Pub93] M. Mikołajewski, W. Kazubski: “A Resonator Class E Power Amplifier for Low Resistance Load”, *Proc. Second Baltic URSI 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 65-69.
- [Pub94] T. A. Miś: “The Design, Development and Demonstration of Longwave Communica-
- tion System for Lunar Surface Operations”, *Proc. 9th International Systems & Concurrent Engineering for Space Applications Conference: SECESA 2020* (Noordwijk, The Netherlands, Sept. 30-Oct. 2, 2020).
- [Pub95] T. A. Miś: “The Results of IGLUNA 2019 Trans-ice Longwave Communication System Tests”, *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-7, 2020), pp. 118-121.)
- [Pub96] T. A. Miś: “The Performance Analysis and Optimization of IGLUNA 2019 Lunar-Analogue Longwave Transmitting System”, *Proc. Second Baltic URSI 2020* (Warsaw, Poland, Oct. 5-8, 2020).
- [Pub97] T. A. Miś: “Rejestracja i wstępna analiza sygnałów długofalowych ziemskich systemów radiodyfuzyjnych w przestrzeni kosmicznej” (Registration and Preliminary Analysis of Signals from Long-wave Terrestrial Radiodiffusion Systems in Space), *Mat. XXVIth Krajowej Konferencji Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2020* (Proc. XXVIth National Conference on Radiocommunications and Broadcasting (Łódź, Poland, Sept. 17-18, 2020).
- [Pub98] T. A. Miś: “Projekt i analiza termiczna wzmacniacza mocy POWER MOSFET dla specjalnych systemów nadawczych w zakresie fal długich i bardzo długich” (Design and Thermal Analysis POWER MOSFET Amplifier for Special Transmission Systems in Long and Very Long Waves), *Mat. XXVIth Krajowej Konferencji Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2020* (Proc. XXVIth National Conference on Radiocommunications and Broadcasting (Łódź, Poland, Sept. 17-18, 2020).
- [Pub99] T. A. Miś: “Eksperymentalna tranzystorancja i antena zastępcza RCN Konstantynów” (Experimental Transistor Fraction and RCN Konstantynów Replacement Antenna), *Mat. XXVIth Krajowej Konferencji Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2020* (Proc. XXVIth National Conference on Radiocommunications and Broadcasting (Łódź, Poland, Sept. 17-18, 2020).
- [Pub100] T. A. Miś: “Częstotliwościowo-dystrybuacyjna analiza szumów w radiofonicznym pasmie fal długich” (Frequency-Distribution Noise Analysis in Long Radio Frequency Band), *Mat. XXVIth Krajowej Konferencji Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2020* (Proc. XXVIth National Conference on Radiocommunications and Broadcasting (Łódź, Poland, Sept. 17-18, 2020).
- [Pub101] T. A. Miś: “The Results of IGLUNA 2019 Trans-Ice Longwave Communication System Tests”, *Proc. 23rd International Microwave and Radar Conference: MIKON 2020*

PUBLICATIONS

- (Warsaw, Poland, Oct. 5-7, 2020), pp. 118-120.*)
- [Pub102] T. A. Miś: "The Performance Analysis and Optimization of IGLUNA 2019 Lunar-analogue Longwave Transmitting System", *Proc. Second Baltic URSI 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 52-56.
- [Pub103] N. Osiadała, M. Kołakowski: "The Use of MEMS Accelerometers for Remote Activity and Living Parameters Monitoring", *Proc. Second Baltic URSI 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 73-76.
- [Pub104] A. Pacewicz: "Metody rezonansowe charakteryzacji mikrofalowej kulek ferromagnetycznych" (Resonance Methods for Microwave Characterization of Ferromagnetic Spheres), *Mat. 21 Seminarium – Radiokomunikacja i Techniki Multimedialne* (Proc. 21st Seminar – Radiocommunications and Multimedia Technologies) (Warsaw, Poland, Dec. 09, 2020), pp. 51-56.
- [Pub105] A. Pacewicz, B. Salski, J. Krupka, P. Kopyt, A. Nabiałek, O. Chumak: "Broadband Microwave Characterization of Mono-and Polycrystalline Magnetic Garnet Spheres", *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 105-110.*
- [Pub106] A. Pietrzak: „Ocena ekspozycji muzyków na dźwięk z wykorzystaniem dwukanałowej dozymetrii hałasowej” (Assessment of Musicians' Exposure to Sound with the Use of two-Channel Nose Dosimetry), *Mat. 21 Seminarium – Radiokomunikacja i Techniki Multimedialne* (Proc. 21st Seminar – Radiocommunications and Multimedia Technologies) (Warsaw, Poland, Dec. 09, 2020), pp 45-50.
- [Pub107] B. Połok, P. Bilski: "Diagnostics of the Ratchet Mechanism Using the Acoustic Analysis", *Proc. 17th IMEKO TC 10 and EUROLAB Virtual Conference "Global Trends in Testing Diagnostics & Inspection for 2030"* (Zagreb, Croatia, Oct. 20-22, 2020), pp. 214-219.
- [Pub108] K. Poźniak, G. Kasprowicz, W. Zabłoński, G. Pastuszak, A. Buchowicz, et al.: "Video Signals Integrator Prototype System", *Proc. SPIE Photonics Applications in Astronomy, Communications, Industry, and High Energy Physics Experiments*, vol. 11581, 2020, doi: 10.1117/12.2591375.*
- [Pub109] A. Raniszewski: "A New Approach to Plane Wave Injection based on G-TF/SF Method in 3D FDTD", *Proc. 23rd International Microwave and Radar Conference MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020).*
- [Pub110] A. Raniszewski, B. A. Słojewska, P. Piaśnicki, J. Strycharz: "Miniaturized 3D-printed Antenna Realizations for Cylindrical Surface Mounting", *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 371-375.*
- [Pub111] D. Rosołowski: "Experimental Evaluation of PA Digital Predistortion Based on Simple Feedforward Neural Network", *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020).*
- [Pub112] D. Rosołowski, P. Korpas: "IQ-imbalance and DC-offset Compensation in Ultrawide-band Zero-IF Receiver", *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 209-213.*
- [Pub113] B. Salski, T. Karpisz, P. Kopyt, J. Krupka: "Plane-wave Expansion Method for Calculating Modes in a Fabry-Perot Open Resonator", *Proc. 23rd International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020).*
- [Pub114] B. Salski, T. Karpisz, P. Kopyt, J. Krupka: "Characterization of Dielectric Materials for 5G Telecommunications with a Fabry-Perot Open Resonator", *Proc. Electronic Materials and Applications: EMA 2020* (Orlando, USA, Jan. 22-24, 2020).
- [Pub115] J. Sobolewski, Y. Yashchyshyn: „Application of Acousto-Optical Materials for Modulation of Sub-Terahertz Signal in Coplanar Structures,” *Proc. 2020 IEEE 15th International Conference on Advanced Trends in Radioelectronics, Telecommunications and Computer Engineering (TCSET)*, Lviv-Slavskie, Ukraine, 2020, pp. 272-275.*
- [Pub116] L. Tomaszewski, S. Kukliński, R. Kołakowski: „A New Approach to 5G and MEC Integration”, *Proc. MHDW 2020 and 5G-PINE 2020* (Neos Marmaras, Greece, June, 5-7, 2020), *Artificial Intelligence Applications and Innovations. AIAI 2020 IFIP WG 12.5 Workshops*, I. Maglogiannis, L. Iliadis, E. Pimenidis (eds.), pp. 15-24.
- [Pub117] J. Tymoszuk, F. Walesiak, J. Fabisiak, M. Szymański, A. Pieczul, T. A. Miś: "Lessons Learned – A Students Approach to Designing a Rover for an Analogue Mars Mission", *Proc. 9th International Systems & Concurrent Engineering for Space Applications Conference: SECESA 2020* (Noordwijk, The Netherlands, Sept. 30-Oct. 2, 2020).
- [Pub118] J. Tymoszuk, F. Walesiak, J. Fabisiak, M. Szymański, A. Pieczul, T. A. Miś: "Designing a Rover for an Analog Mars Mission", *Proc. 23rd Annual International Mars Society Convention* (USA, 15-18 Oct. 2020).
- [Pub119] M. Wan, Y. Yashchyshyn, X. Li, K. Godziszewski, D. W. Sun, et al.: "Characterization of Silicon in the Terahertz", *Proc. SPIE 11279, Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications XIII*, L. P. Sadwick, T. Yang (eds.), SPIE OPTO (San Francisco, USA, Feb. 1-6, 2020), doi: 10.1117/12.2547339, pp. 112792D-1-112792D-8.*

- [Pub120] A. Wójcik: "Identyfikacja stanu odbiorników energii elektrycznej z wykorzystaniem generatora sygnału impulsowego" (Identification of the State of Electricity Receivers with the Use of a Pulse Signal), *Mat. 21 Seminarium – Radiokomunikacja i Techniki Multimedialne* (Proc. 21st Seminar – Radiocommunications and Multimedia Technologies) (Warsaw, Poland, Dec. 09, 2020).
- [Pub121] A. Wójcik, R. Łukaszewski, R. Kowalik, K. Dowalla: „Układ pomiarowy oraz metoda wykrywania zmiany stanu odbiorników energii elektrycznej wykorzystująca generator sygnału impulsowego” (A Measuring System and a Method for Detecting Changes in the State of Electric Energy Receivers Using a Pulse Signal Generator), *Mat. XIII Konferencja Naukowa: Systemy Pomiarowe w Badaniach Naukowych i w Przemyśle* (Proc. XIIIth Scientific Conference: Measurement Systems in Research and Industry) (Zielona Góra, Poland. Jun. 14-17, 2020), pp. 261-275.
- [Pub122] Y. Yashchyshyn, D. Vynnyk, V. Haiduchok, I. Solskii: „Experience of Full-Wave Electromagnetic Modeling of RF Transducers for Acousto-Optic Modulator”, *Proc. 2020 IEEE 15th International Conference on Advanced Trends in Radioelectronics, Telecommunications and Computer Engineering (TCSET)* (Lviv-Slavskie, Ukraine, 2020), pp. 113-116. ”
- [Pub123] Y. Yashchyshyn, D. Vynnyk, V. Haiduchok, I. Solskii, C. Wu, G. Bogdan: "Electrically Small Antenna for BeiDou Chinese Navigation Satellite System", *Proc. 23^d International Microwave and Radar Conference: MIKON 2020* (Warsaw, Poland, Oct. 5-8, 2020), pp. 92-94.”
- [Pub128] K. Kuczyński, A. Bilski, P. Bilski, J. Szymański: „New Concept Cylindrical Magnetoelectric Magnetic Field Sensor”, *Proc. Book with Abstract of Papers, 9th International Conference on Computing, Communication and Sensor Networks: CCSN 2020* (Kolkata, India, Oct. 17-18, 2020), 1 p.
- [Pub129] T. A. Miś: “Terrestrial Man-made RF LF Emissions as Potential Heliosphere-shaping Contributing Factors and Information Sources for Space Missions”, *3rd Interstellar Probe Exploration Workshop* (Laurel, Maryland, USA, Nov. 16-20, 2020), Johns Hopkins University Applied Physics Laboratory, poster.
- [Pub130] R. Rola, N. Hryniewicz, D. Ryglewicz, E. Piątkowska-Jankó, P. Bogorodzki: „Alteration of Brain Oxygen Metabolism Triggered by the Interictal Epileptiform Discharges (IEDs) in Patient with Primary Generalized (PGE) Epilepsis. Assessment of Blood Oxygenation Level Dependent (BOLD) Signal Changes – EEG-fMRI Preliminary Study”, *6th Congress of the European Academy of Neurology, European Journal of Neurology*, vol. 27, supplement 1, May 2020, abstract no. EPO 2147, pp. 855-856.
- [Pub131] A. Tempes, K. Ryczek, A. Malik, A. Brzozowska, M. Macias, A. Szczepaniewicz, M. Bakun, T. Rubel, R. De Pace, C. Guardia, J. Bonifacino, J. Jaworski: “mTOR Regulates p150 Glued - AP2 Complex Interaction and TrkB Transport. Virtual EMBO Meeting Microtubules: From Atoms to Complex Systems”, *EMBO/EMBL Symposium* (3-6 June 2020).

6.4. Textbooks

- [Pub124] S. Rosłoniec: "Podstawy radiolokacji i radionawigacji" (Basics of Radiolocation and Radionavigation), *Wojskowa Akademia Techniczna*, issue 2, 2020, ISBN 978-83-8156-139-6, 489 pp.
- [Pub125] S. Rosłoniec: "Wybrane metody numeryczne z przykładami zastosowań w obliczeniach inżynierskich" (Selected Numerical Methods with Applications in Engineering Tasks), *Oficyna Wydawnicza PW*, issue 3, 2020, ISBN 978-83-8156-113-6, 436 pp.
- [Pub126] K. M. Snopk, J. Wojciechowski: "Sygnały i systemy – zbiór zadań" (Signals and Systems – Exercises), *Oficyna Wydawnicza PW*, issue 2, 2020, ISBN 978-83-7207-858-2, 432 pp.

6.5. Abstracts and Posters

- [Pub127] P. Bilski: "Artificial Intelligence Methods in Diagnostics of Analog Systems", *Proc. Book with Abstract of Papers, 9th International Conference on Computing, Communication and Sensor Networks: CCSN 2020* (Kolkata, India, Oct. 17-18, 2020), keynote presentation, 1 p.

7. RESEARCH REPORTS

- [Rep1] P. Bajurko: "Pomiar charakterystyk układu scalonego odbiornika na pasmo 94 GHz" (Measurement Examination of the Integrated Circuit of the Receiver for the 94 GHz Band), Final report for SIRC sp.z.o.o., Warsaw, Jun. 2020.
- [Rep2] P. Bajurko: „Badanie parametrów S zestawu anten i dwuwrotników w zakresie częstotliwości 75-77 GHz” (Examination of S Parameters of a Set of Antenna and Two-Port Devices in the 75-77 GHz Frequency Range), Final report for by THORIUM SPACE sp.z.o.o., Warsaw, Sept. 2020.
- [Rep3] P. Bajurko: „Pomiar parametrów szumowych układu scalonego odbiornika na pasmo 94 GHz” (Measurement of the Noise Parameters of the Receiver's Integrated Circuit for the 94 GHz Band), Final report for SIRC sp.z.o.o., Warsaw, Sept. 2020.
- [Rep4] P. Bajurko, S. Kozłowski: „Pomiar charakterystyk modułu nadajnika na pasmo 94 GHz” (Measurement Examination of Transmitter Module for 94 GHz Band), Final report for SIRC sp.z.o.o., Warsaw, Feb. 2020.
- [Rep5] P. Bajurko, J. Sobolewski: “Pomiary charakterystki antenowej – antena na pasmo S” (Measurement of Antenna Characteristics – Antenna for S-band), Final report for WiRan sp.z.o.o., Warsaw, Jun. 2020.
- [Rep6] P. Bajurko: “Badanie charakterystyk kierunkowych promieniowania anten w strefie dalekiej w zakresie częstotliwości 71,8-79 GHz” (Examination of radiation patterns of antennas in the far field zone in the 71.8-78 GHz frequency range), Final report for THORIUM SPACE sp.z.o.o., Nov. 2020.
- [Rep7] P. Bajurko: “Badanie skuteczności ekranowania materiałów do ochrony EM w paśmie mikrofalowym” (Examination of shielding effectiveness of EMI shielding materials in the microwave frequency range), Final report for GISS sp.z.o.o., Warsaw, Dec. 2020.
- [Rep8] G. Bogdan, P. Bajurko, K. Godziszewski, W. Kazubski: „Kurs radiotechniczny” (Workshop on Radio Engineering), Final report for the Faculty of Power and Aeronautical Engineering, WUT, Warsaw, Jul. 2020.
- [Rep9] P. Bogorodzki, E. Piątkowska-Janko, W. Obrebski, M. Wieteska: “Badania obrazowe mózgu małych zwierząt z wykorzystaniem techniki MRI” (Imaging Studies of Small Animal Brain Using MRI Techniques), Final report for Neurovet Małgorzata Mikuła, Warsaw, Jun. 2020.
- [Rep10] P. C. Brandt, R. L. McNutt Jr, E. Powernikova, R. Wimmer-Schweingruber, P. Mostafavi, R. Demajistre, K. Mandt, C. Lisse, K. Runyon, A. Rymer, S.M. Krimigis, E. C. Roelof, Michael V. Paul, M. Blanc, V. Merlin, L. Alkalai, B. Alterman, D. N. Baker, S. Bale, S. Barabash, J. -L. Bertaux, C. Beichman, M. Bzowski, J. Clark, E. Christian, J. Cooper, R. Decker, M. Desai, K. Dielynas, S. Eriksson, P. Frisch, L. Fisk, H. O. Funsten, S. Fuselier, A. Galli, R. Gladstone, D. Gurnett, G. Gloeckler, M. Gruntman, M. Hill, M. Horanyi, V. Izmodenov, S. Kempf, O. Katushkina, W. Kurth, R. Ratkiewicz, T. A. Miś, et al.: „Expanding the Realm of Solar & Space Physics: Exploration of the Outer Heliosphere and Local Interstellar Medium”. A White Paper to the the NASA Heliophysics Vision 2050 Workshop, Washington, USA, Sept. 2020.
- [Rep11] D. Gryglewski, W. Wojtasik, D. Rosołowski, P. Korpas, D. Kuchta, M. Góralczyk, D. Kołodziej, M. Lubiejewski: „Technologie materiałów półprzewodnikowych dla elektroniki dużych mocy i wysokich częstotliwości” (Semiconductor Technology for High Power Electronics and High Frequencies), Final report for the National Centre for Research and Development, Warsaw, Nov. 2020.
- [Rep12] J. Kołakowski, J. Cichocki, M. Kołakowski, V. Djaja-Jośko: „System wsparcia osób z zaburzeniami poznawczymi w środowisku domowym i poza domem” (Indoor and Outdoor NITICplus Solution for Dementia Challenges), Final report for National Centre for Research and Development, Warsaw, Mar. 2020.
- [Rep13] P. Kopyt, B. Salski: „Metody i sposoby ochrony i obrony przed impulsami HPM” (Methods of Protection and Defense Against the HPM Impulses), Final report for the National Science Centre, Warsaw, Dec. 2020.
- [Rep14] J. Krupka, P. Kopyt, B. Salski, T. Karpisz: “Standardyzacja pomiarów elektromagnetycznych wilgotności gleby” (The Standardization of Electromagnetic Measurements of Soil Moisture, in short BDS&Soi), Final report for the Polish National Agency for Academic Exchange, Warsaw, Nov. 2020.
- [Rep15] A. Pacewicz: “Modelowanie i optymalizacja mieszanego czterofalowego we włóknach światłowodowych na potrzeby generacji promieniowania terahercowego” (Modelling and Optimization for Four Wave Mixing in microstructured Optical Fibers Generation), Final report for the Ministry of Science and Higher Education, Warsaw, Mar. 2020.

- [Rep16] B. Salski, P. Kopyt, M. Krysicki: "Pełnofaliowe modelowanie elektromagnetyczne zjawiska generacji promieniowania koherentnego w pompowanych elektrycznie laserach półprzewodnikowych z metalizowanym rezonatorem składanym" (Full-Wave Electromagnetic Modeling of Coherent Radiation in Electrically-Pumped Metal-Clad Semiconductor Micro-Lasers with a Folded Metallic Resonator), Final report for the National Science Centre, Warsaw, Nov. 2020.
- [Rep17] W. Smolik, P. Brzeski, J. Kryszyn, T. Olszewski, R. Szabatin, M. Stosio, D. Wanta, P. Wróblewski: „Wykonanie usługi badawczej w projekcie z Funduszu Europejskiego Inteligentny Rozwój pt."Tomograf elektryczny do innowacyjnego obrazowania i monitorowania obszarowego z wykorzystaniem mapy potencjałów węzłowych" (Scientific Studies on the Intelligent Development European Fund „Electrical Tomograph for innovative Imaging and Area Monitoring using Node Potentials Map), Final report for NETRIX S.A., Jan. 2020.
- [Rep18] W. Smolik, A. Rychter, J. Kryszyn, D. Wanta: „Usługi badawcze i eksperckie w celu realizacji projektu pt. "Przeprowadzenie prac badawczo-rozwojowych w zakresie opracowania oraz implementacji zintegrowanej nowoczesnej Platformy Transakcyjnej przełomowej pod względem parametrów wydajnościowych i pojemnościowych oraz nowatorskich protokołów komunikacyjnych oraz algorytmów zawierania transakcji" (Research and development works in the area of developing and implementing an integrated modern breakthrough trading platform in terms of performance and capacity parameters as well as innovative communication protocols and transaction algorithms), Final report for Giełda papierów Wartościowych S.A., Warsaw, Apr. 2020.
- [Rep19] W. Wojtasik: "Udostępnienie mikrofalowej aparatury pomiarowej" (Use of Equipment with the Testing Instrumentation), Final report for QWED sp.z.o.o, Warsaw, Apr. 2020.
- [Rep20] W. Wojtasik, D. Gryglewski, D. Rosołowski, P. Korpas: „Opracowanie prototypu radaru wielofunkcyjnego kierowania ogniem ze skanowaniem fazowym wiązki w dwóch płaszczyznach dla zestawu rakietowego OP średniego zasięgu, kryptonim WISŁA" (Development of a Prototype Radar Fire Control Multi-phase Scanning Beam in Two Planes for a Set of Medium-Range Missile OP, Codenamed Vistula), Final report for the Final report for the National Science Centre, Warsaw, Dec. 2020.
- [Rep21] Y. Yashchyshyn, D. Nyzovets: "Konvergenja elektroniki i technik fotonicznych na rzecz rozwoju zastosowań techniki" (Convergence of Electronics and Photonics Technologies for Enabling Terahertz Applications, CELTA), Final report for EU Framework Programme for Innovative Training Networks, Horizon 2020, Warsaw, Feb. 2020.
- [Rep22] Y. Yashchyshyn, K. Godziszewski: "Badania przestrajalności kompozytów BST/polimer w zakresie częstotliwości do 500 GHz" (BST/Polymer Composites Tunability Studies in the Frequency Range up to 500 GHz), Final report for the Faculty of Chemistry, WUT, Oct. 2020.
- [Rep23] K. Zaremba, J. Marzec, R. Kurjata, M. Ziembicki, A. Rychter: „Eksperyment COMPASS – badania wewnętrznej struktury nukleonu" (Experiment COMPASS – Study of the Internal Structure of the Nucleon), Final report for the National Science Centre, Warsaw, May 2020.
- [Rep24] J. Żera: "Przeprowadzenie pomiarów akustycznych urządzenia voice service kiosk" (Acoustic measurement of voice service kiosk), Final report for M4B S.A., Warsaw, Sept. 2020.

8. PATENTS AND PATENT APPLICATIONS

- [Pat1] G. Bogdan, Y. Yashchyshyn: „Sposób kształtowania charakterystyki polaryzacyjnej w antenie z przełączaną charakterystyką polaryzacyjną, antena z przełączaną charakterystyką polaryzacyjną oraz szyk antenowy takich anten” (The method of shaping the polarization pattern in an antenna with switched polarization characteristics, and antenna with switched polarization characteristics and such antennas array) patent application no. P.433911, May 13, 2020.
- [Pat2] Y. Yashchyshyn, G. Bogdan: „Antena elektrycznie mała oraz sposób jej strojenia” (Electrically small antenna and its tuning techniques), patent application no. P.434186, Jun. 3, 2020.

9. SCIENTIFIC EVENTS

Due to the the coronavirus pandemic conference organizers has decided to cancel all in-person attendance and face-to-face activities. This chapter contains the list of conferences that have been mostly held remotely.

9.1. Scientific events co-organized by the Institute

- [Con1] *The 9th Microwave and Radar Week: MRW - 2020* with parallel conferences: 23rd International Microwave and Radar Conference: MIKON 2020, and Second Baltic URSI Symposium (Warsaw, Poland, Oct. 5-8, 2020), J. Modelska (co-chair of MRW 2020, member of the MIKON 2020 Technical Program Committee), B. Salski (co-chair of the MIKON 2020, chair of the Technical Program Committee), W. Gwarek, P. Kopyt, W. Wojtasik, Y. Yashchyshyn (members of the MIKON 2020 Technical Program Committee), M. Krysicki (member of the MRW 2020 Organizing Committee), K. Godziszewski (co-chair of session), M. Mikołajewski (chair of session), P. Bajurko, G. Bogdan, J. Cuper, K. Godziszewski, V. Djaja-Joško, M. Góralczyk, D. Gryglewski, T. Karpisz, J. Kołakowski, M. Kołakowski, P. Kopyt, P. Korpas, M. Krysicki, K. Kurek, D. Kuchta, P. Miazga, T. A. Miś, A. Pacewicz, P. Piasiecki, A. Raniszewski, D. Rosołowski, J. Sobolewski, M. Sypniewski (participants).

9.2. International scientific events

- [Con2] *Electronic Materials and Applications: EMA 2020* (Orlando, USA, Jan. 22-24, 2020), B. Salski, P. Kopyt (participants).
- [Con3] *2020 IEEE 15th International Conference on Advanced Trends in Radioelectronics, Telecommunications and Computer Engineering: TCSET 2020* (Lviv-Slavskie, Ukraine, Feb. 24-29, 2020), Y. Yashchyshyn, P. Bajurko, J. Sobolewski (participants).
- [Con4] *Workshop “New and Enhanced Photosensor Technologies for Undergroung/ Underwater Neutrino Experiments (NEPTUNE)”* (Caserta, Italy, Mar. 10-13, 2020), M. Ziembicki (participant).
- [Con5] *2020 IEEE International Instrumentation & Measurement Technology Conference: I2MTC 2020* (Dubrovnik, Croatia, May 25-28, 2020), P. Mazurek (speaker).
- [Con6] *2020 IEEE-MTT-S International Microwave Symposium* (Los Angeles, USA, Aug. 4-6, 2020), J. Cuper (speaker), B. Salski, T. Karpisz, P. Korpas, A. Pacewicz, P. Kopyt (participants).
- [Con7] *Summer XLVIth IEEE-SPIE Joint Symposium: Photonics Applications in Astronomy, Communications, Industry, and High Energy Physics Experiments 2020* (Wilga, Po-

land, Aug. 31 - Sept. 2, 2020), A. Buchowicz, G. Pastuszak (participants).

- [Con8] *The 24th IEEE International Conference on Signal Processing: Algorithms, Architectures, Arrangements, and Applications: SPA 2020* (Poznań, Poland, Sept. 23-25, 2020), Z. Kulka, J. Modelska, W. Skarbek (members of the Scientific Committee).
- [Con9] *9th International Systems & Concurrent Engineering for Space Applications Conference: SECESA 2020* (Noordwijk, The Netherlands, Sept. 30-Oct. 2, 2020), T. A. Miś (participant).
- [Con10] *23rd Annual International Mars Society Convention (Virtual Edition)* (USA, Oct. 15-18, 2020), T. A. Miś (participant).
- [Con11] *9th International Conference on Computing, Communication and Sensor Networks: CCSN 2020* (Kolkata, India, Oct. 17-18, 2020), P. Bilski (keynote speaker).
- [Con12] *5th International Symposium on Smart and Wireless Systems within the International Conferences on Intelligent Data Acquisition and Advanced Computing Systems: IEEE IDAACS-SWS 2020* (Dortmund, Germany, Oct. 17-18, 2020), P. Bilski (member of the Technical Board).
- [Con13] *17th IMEKO TC 10 and EUROLAB Virtual Conference “Global Trends in Testing Diagnostics & Inspection for 2030”* (Zagreb, Croatia, Oct. 20-22, 2020), P. Bilski, G. Makarewicz (the Best Paper presenters).
- [Con14] *7th Electronic Conference on Sensors and Applications* (Beijing, China, Nov. 15-30, 2020), K. Godziszewski (participant).
- 9.3. National scientific events**
- [Con15] *XIII Konferencja Naukowa: Systemy Pomiarowe w Badaniach Naukowych i w Przemyśle* (XIIIth Scientific Conference: Measurement Systems in Research and Industry) (Zielona Góra, Poland, Jun. 14-17, 2020), P. Bilski (member of the Scientific Committee, session chair), R. Łukaszewski (participant), K. Dowalla, A. Wójcik (speakers).
- [Con16] *XIX Krajowa Konferencja Elektroniki: KKE 2020* (XIXth National Conference on Electronics) (Darłowo, Poland, Aug. 30-Sept. 2, 2020), D. Gryglewski (speaker).
- [Con17] *Krajowa Konferencja Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2020* (XXVIth National Conference on Radio-communications and Broadcasting) (Łódź, Poland, Sept. 17-18, 2020), J. Cichocki, J. Modelska, W. Skarbek, Y. Yashchyshyn (members of the Program Committee), P. Bobiński, G. Bogdan, K. Godziszewski, J. Kołakowski, W. Kazubski, M. Kołakowski, T. Kosiło, P. Korpas, K. Kurek,

T. A. Miś, K. Radecki, P. Piasecki,
B. Salski, J. Sobolewski (participants).

- [Con18] *Krajowe Sympozjum Telekomunikacji i Teleinformatyki 2020* (National Symposium on Telecommunications and Teleinformatics 2020) (Łódź, Poland, Sept. 17-18, 2020), J. Modelska, W. Skarbek (members of the Program Committee).
- [Con19] *Konferencja Rektorów Akademickich Szkół Polskich* (Conference of Rectors of Academic Schools in Poland) (Kraków, Poland, Sept. 26-27, 2020), K. Zaremba (head of the Education Commission).
- [Con20] *21 Seminarium: Radiokomunikacja i Techniki Multimedialne* (21st Seminar: Radiocommunications and Multimedia Technologies) (Warsaw, Poland, Dec. 09, 2020), J. Kołakowski, B. Salski (session chairs), A. Pietrzak, V. Djaja-Joško, M. Łucjan, A. Pacewicz, A. Wójcik.

10. AWARDS AND DISTINCTIONS

State Medals

**Wojciech Gwarek (em.), Prof. D.Sc.,
Krzysztof Zaremba, Prof. D.Sc.,**

Krzyż Kawalerski Orderu Odrodzenia Polski (Knight's Cross of the Order of Polonia Restituta).

Wojciech Kazubski, Ph.D.

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

Andrzej Buchowicz, Ph.D.

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

Awards granted by international bodies

IEEE Transactions on Instrumentation and Measurement recognized **Professor Roman Z. Morawski** as the most published author of all time from Poland.

Professor Roman Z. Morawski was included in the *Mendeley Data*, a publicly available database of 100,000 top-scientists that provides standardized information on citations, h-index, co-authorship adjusted hm-index, citations to papers in different authorship positions.

Piotr Bilski, D.Sc.,

Grzegorz Makarewicz, Ph.D.

Certificate of Award for the best Scientific Paper & Presentation in recognition of professional excellence, the paper titled "Diagnostics of the RIAA Equalizer in a Turntable Using Artificial Neural Network" presented at the 17th IMEKO TC10and EUROLAB Virtual Conference: "Global Trends in testing, Diagnostics & Inspection for 2030" (Zagreb, Croatia, Oct. 20-22, 2020).

Piotr Bilski, D.Sc.

2nd prize award at the Best Paper Competition for keynote talk: "Artificial Intelligence Methods in Diagnostics of Analog Systems" at 9th International Conference on Computing Communication and Sensor Networks: CCSN 2020 (Kolkata, India, Oct. 17-18, 2020).

Adam Pacewicz, M.Sc.

IInd award granted by AP/AES/MTT Joint Chapter Poland Section IEEE for the M.Sc. thesis titled: "Ferromagnetic resonance spectroscopy of thin films at microwave frequencies".

Awards in the Young Scientists Contest at international conferences

Vitomir Djaja-Joško, M.Sc.

"Blažo Mirčevski" award for the best paper titled "New synchronization method for UWB TDOA based localization system utilizing two reference nodes", presented at 27th Telecommunications Forum: TELFOR 2019 (Belgrade, Serbia Nov. 26-29, 2019).

Adam Pacewicz, M.Sc.

IInd award granted by European Microwave Association (EuMA) fro the paper titled: "Broadband Microwave Characterization of Mono-And Polycrystalline Magnetic Garnet Spheres", 23rd International Microwave and Radar Conference (Warsaw, Poland Oct. 5-8, 2020).

**Natalia Osiadała, M.Sc.,
Marcin Kołakowski, M.Sc.**

The distinguished paper titled: "The Use of MEMS Accelerometers for Remote Activity and Living Parameters Monitoring", Second Baltic URSI 2020 (Warsaw, Poland, Oct. 5-8, 2020).

Awards granted by national bodies

Józef Modelska, Prof. D.Sc.

Member of the Polish Space Agency Board.

Grzegorz Bogdan, Ph.D.

START 2020 Program Scholarship granted by the Foundation for Polish Science.

Dawid Kuchta, Ph.D.

Award for the Ph.D. thesis in the Innovator of Mazovia Programme.

I⁰ award for the best Ph.D. thesis in the Ministry of Defence Competition.

Awards of the Rector

Krzysztof Zaremba, Prof. D.Sc.

Individual I⁰ award for the organizational achievements.

Roman Z. Morawski, Prof. D.Sc.

Individual I⁰ award for all the achievements.

Władysław Skarbek, Prof. D.Sc.

Individual I⁰ award for all the achievements.

Bartłomej Salski D.Sc.

Individual I⁰ award for the didactic achievements, and individual and team III⁰ award for the organizational achievements.

Awards of the Foundation for the Development of Radiocommunications and Multimedia Technologies for the Best Ph.D. Thesis.

Grzegorz Bogdan, Ph.D.

Ist award for the Ph.D. dissertation titled: „Adaptacyjne kształtowanie charakterystki kierunkowej anteny z modulacją czasową” (Adaptive beamforming in a time modulated antenna array), Krajowa Konferencja Radiokomunikacji, Radiofonii i Telewizji: KKRRiT 2020 (National Conference on Radiocommunications and Broadcasting) (Łódź, Poland, Sept. 17-18, 2020).

Scholarships of the Foundation for the Development of Radiocommunications and Multimedia Technologies granted in 2020.

Piotr Czeała

Michał Maciąła

For preparing M.Sc. thesis

Adam Pacewicz

Augustyn Wójcik

For preparing Ph.D. thesis

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

SPECIFICATION	2017	2018	2019	2020
academic staff [posts]				
total	60,33	57,5	54,5	56
professors	4,5	4	4	5,5
University professors	9,5	9	9	8
associate professors	2	3	2	1
assistant professors	29,5	24,5	26,5	30,5
readers	1	1	1	1
senior lecturers	4,33	5,5	5	2,5
assistants	9,5	10,5	7	7,5
Ph.D. students [persons]				
total	37	37	38	39
with scholarship	23	25	30	33
without scholarship	14	12	8	6
technical and administrative staff [posts]				
total	15,5	14,25	16,65	13,3
senior R&D associates	1	1,5	1,5	1
R&D associates	4	2	4,75	3,5
administrative associates	8,5	8,75	8,4	6,8
service workers	2	2	2	2
temporary staff [persons]				
	2	2	5	
teaching activities				
basic courses	63	58	50	57
advanced courses	28	32	28	27
other courses	38	26	23	15
international projects, courses and lectures	1	3	4	1
research projects				
total	50	48	52	51
International granted by EU	3	4	4	4
granted by the Ministry	17	17	20	22
granted by the University	14	14	16	7
other	16	13	12	18
titles and degrees awarded				
Prof. titles	1	0	0	0
D.Sc. degrees	1	0	1	0
Ph.D. degrees	2	4	2	6
M.Sc. degree (regular studies + evening studies)	48+1	42+1	39+2	43+1
M.Sc. degree (studies in English)	3	3	0	0
B.Sc. degrees (regular studies + evening studies)	80+2	76+5	69+5	63+5
B.Sc. degrees (studies in English)	2	0	0	0
B.Sc. degrees e-learning	1	1	1	2
publications				
total	149	153	123	131
sci.-tech. books and chapters in books	7	2	2	2
sci.-tech. papers in journals - total	73	57	37	62
JCR-ICI list (IF>0)	40	33	31	52
in other journals	3	7	14	10
sci.-tech. papers in conference proceedings	55	89	55	59
other publications	11	5	12	8
patents and patent applications				
international	0	0	0	0
national	5	4+2	3	2
research reports				
	28	25	33	24
scientific events attended by the staff				
	40	35	45	20

APPENDIX:

EXPLANATORY NOTE ON POLISH ACADEMIC AND PROFESSIONAL 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 **wykładowca**, translated here as **Lecturer** – the professional title of *magister* or *magister inżynier*;
- for the post of **starszy wykładowca**, translated here as **Senior Lecturer** – the *doktor* or *magister inżynier* 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 **profesor uczelni**, translated here as **Associate Professor** – the *doktor habilitowany* degree;
- for the post of **profesor**, translated here as **Full Professor** – the professor title.

More details concerning academic and professional titles, degrees and posts may be found in the Act on Higher Education from 2018 (with further addendments)

