INSTITUTE OF RADIOELECTRONICS AND MULTIMEDIA TECHNOLOGY

WARSAW UNIVERSITY OF TECHNOLOGY

FACULTY OF ELECTRONICS AND INFORMATION TECHNOLOGY

ANNUAL REPORT

2024

Warsaw, January 2025

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From the Director

Dear Friends and Colleagues,

The year 2024, which outcomes are presented in the following edition of the Annual Report, was marked by important events driving substantial changes in the Institute of Radioelectronics and Multimedia Technology. We welcomed the year 2025 with high expectations, but also awareness of the transformation challenges we are confronted with.

In September 2024, the Board of Directors had been changed. Being the former Vice-Director of the Institute, I humbly accepted role of Director. My sincere gratitude goes for Prof. J. Modelski, who for many years was the outstanding (and exceptional) Director of the Institute.

Looking back at the past year, I can say with full confidence that the tasks set before the institute in January 2024 have been successfully completed. War just beyond our borders has not disrupted our activities. Our thoughts and feelings are with the brave nation of Ukraine as they defend against the Russian threat. However, as we are looking into the future with an increasing optimism, it's also the time for the brief summary of the past period. Scientifically, our institute has been steadily growing. This is evidenced by the significant number of solid publications in the JCR list, evaluated between 100 and 140 points by Polish Ministry of Science. Additional, three monographs authored or co-authored by our most active researchers summarize long-term research findings. We hope these endeavors will be fruitful in increasing the economic assets of the Institute. Scientific activities include participation in conferences, which, although less frequent this year, remain significant. Our staff was involved in organization of the *11th Microwave & Radar Week: MRW 2024*. Congratulations go for J. Modelski (General Chair of *MRW 2024*), M. Krysicki, J. Cuper (members of the Organizing Committee), P. Kopyt, B. Salski, W. Wojtasiak, Y. Yashchyshyn (members of the Technical Programme Committee – *MIKON 2024)*. Additionally, we were involved in the Radiocommunication and Teleinformatics Conference held in Poznan in Sep. 11-13, 2024.

A significant part of the Institute's activities involves participating in and leading research grants. The past year has been particularly successful for us, as we were able to continue the existing endeavors, such as "Infostrateg" program, financed by the National Centre of Research and Development. Thanks to Dr. Marcin Ziembicki leadership his team's achieved astounding success with the "Super Kamiokande to Hyper-Kamiokande" project under the Horizon 2020 program and "Hyper Kamiokande" (funded by the National Centre of Research and Development). Also, prof. Yevhen Yashchyshyn initiated the European endeavour under the Horizon Europe: "Novel Technologies and Materials for TeraHertz Radiation Control", which is the successor to the previous project "Innovation optical/quasioptical technologies and nanoengineering of anisotropic materials for creating active cells with substantially improved energy efficiency", which ended in 2024. We hope that these successes will inspire other researchers to redouble their efforts secure financing for their projects. Last year, the number of doctoral students was 24, which is a rich base for potential new scientific staff in the future.

In terms of didactic activities, our contributions to the Faculty operations have been strong, as usual. In 2024, a new second-cycle study program in Telecommunications was developed. The Senate of WUT approved the program in December 2024, and the first recruitment of students for the new study program took place in February 2025. Significantly more students applied for the new study program than for the previously offered one.

Many long-time staff members have been awarded medals and distinctions, including the medal of the National Education Committee. We extend our sincere congratulations to all awarded colleagues. Additionally, multiple students had been recognized by the Rector for their outstanding achievements at the BSc and MSc levels.

To sum up, we are ready for the exciting new challenges of the next year of 2025. I would like to personally wish the whole staff of our institute as many successes as possible!

Associate Professor Piotr Bilski

Warsaw, January 2025

Classification of publications presented in this Report
is in accordance with the rules in force in 2024

Contents

1. GENERAL INFORMATION

1.1. Mission of the Institute

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

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

- In Radioelectronics

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

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

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

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

- In Multimedia

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

- In Nuclear and Medical Electronics

Nuclear and Medical Electronics assemble designing of the detectors and front-end electronics for high energy physics and neutrino experiments (e.g. AMBER, WCTE – CERN, T2K, HyperK – Japan), software and hardware developments in Magnetic Resonance Imaging (MRI), like studies of hyperpolarization (DNP) with RF and processing methods in functional and structural neuroimaging, data

analysis in proteomics, software and hardware developments in Electrical Capacitance Tomography and Nanoparticle Magnetic Tomography.

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

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

1.2. Board of Directors

Director of the Institute

Józef Modelski, Prof. D.Sc., Full Professor (till Sept. '24)
Piotr Bilski, D.Sc., Associate Professor (from Oct. '24)
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Secretariat

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Deputy Director for Research

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Secretariat

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Director's Representative for Economy & Admini-stration

Piotr Brzeski, Ph.D., Didactic Assistant Professor (0.3), (till Sept. '24)

Director's Representative in Administrative

Mateusz Krysicki, M.Sc., Assistant, (from Oct. '24)
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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)
Agnieszka P. Pietrzak, Ph.D., Assistant Professor
Krzysztof Mroczek, Ph.D., Assistant Professor
Maciej Jasiński, Ph.D., Assistant Professor

Junior academic staff

Karolina Pondel-Sycz, M.Sc., Assistant (0,5), from Feb. '24

Technical staff

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

Ph.D. Students

Dina Al-Daloo, M. Sc., from Oct. 2023
Piotr Czarnecki, M.Sc., from Oct. 2019
Salomea Grodzicka, M.Sc., from Oct. 2019
Bartosz Kościug, M.Sc. from Feb. 2021
Ary Kurniadi Irawan, M.Sc., from Oct. 2023
Jacek Majer, M.Sc., from Oct. 2018, till Sep. 2024
Tomasz Markowski, M.Sc., from Feb. 2018
Łukasz Popek, M.Sc., from Oct. 2023
Bartosz Połok, M.Sc., from Oct. 2015
Karolina Pondel-Sycz, M.Sc., from Oct. 2021
Jakub Tkaczuk, M.Sc., from Oct. 2020

Retired

Zbigniew Kulka, Prof. D.Sc.,
Ewa Kotarbińska, Ph.D.,
Andrzej Leszczyński, Ph.D.,
Maria Tajchert, Ph.D.

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

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

Current research topics include:

- digital audio signal processing;
- low-level acoustic signals measurements and analysis;
- objective and subjective methods of sound quality evaluation;
- detection of auditory warning signals in the presence of industrial noise;

- elaboration of computation methods for acoustic field radiated in free space by surface acoustic sources and their implementation on a PC.

The other field of interest concerns fundamental and applied research associated with metrology, instrumentation and measuring systems. It is focused on design of automated computer-based measuring systems. Current research topics include:
- modern information technologies, e.g. LabVIEW, Java, XML, and modern communication technologies, e.g. the Internet, GSM, Bluetooth, ZigBee in distributed control and measuring systems;
- virtual instrumentation, plug-in boards for data acquisition, IEEE-488 equipment;
- artificial intelligence methods in diagnostics of analog systems;
- non-invasive methods for monitoring and analysis of electricity consumption around the end users.

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

1.3.2. Nuclear and Medical Electronics Division

Head of Division

Janusz Marzec, Prof. D.Sc., Full Professor, (till Sept. ’24)
Waldemar Smolik, D.Sc., Associate Professor (from Oct. ‘24)
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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., Didactic Assistant Professor
Robert Kurjata, Ph.D., Assistant Professor
Dariusz Radomski, Ph.D., Research Assistant Professor
Tymon Rubel, Ph.D., Assistant Professor
Andrzej Rychter, Ph.D., Assistant Professor
Damian Wanta, Ph.D., Assistant Professor
Marcin Ziembicki, Ph.D., Assistant Professor
Piotr Brzeski, Ph.D., Didactic Assistant Professor (0.3), (till Sept. ‘24)

Junior academic staff

Krzysztof Dygnarowicz, M. Sc., Assistant (0,5)
Kamil Lipiński, M. Sc., Assistant (0,5)
Wojciech Obrębski, M.Sc., Assistant (0.5)
Tomasz Olszewski, M.Sc., Didactic Assistant (0.5), till Sept. ‘24
Michał Wieteska, M.Sc., Assistant (0.5)
Przemysław Wróblewski, M.Sc., Assistant

Technical staff

Tomasz Olszewski, M.Sc., R&D Engineer (0.5), till Sept. ‘24
Andrzej Wasilewski, Worker

Administrative staff

Yuliya Hoika, M.Sc., till Mar. ‘24

Ph.D. students

Krzysztof Dygnarowicz, M.Sc., from Feb. 2021
Mikhail Ivanenko, M.Sc., from. Oct. 2023
Kamil Lipiński, M.Sc., from Oct. 2019
Mateusz Midura, M.Sc., from Oct. 2019
Michał Nurek, M.Sc., from Oct. 2024
Katarzyna Orzechowska, M.Sc., from Oct. 2019
Przemysław Wróblewski, M.Sc., from Oct. 2021

Retired

Piotr Brzeski, Ph.D. from Oct. ‘24
Tomasz Olszewski, M.Sc. from Oct. ‘24
Zdzisław Pawłowski, Prof. D.Sc.,
Ewa Piątkowska-Janko, Ph.D.,
Roman Szabatin, Ph.D.

The research and teaching activities carried out in the Nuclear and Medical Electronics Division are concentra- ted 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

Wojciech Wojtasiak, D.Sc., Associate Professor
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Senior academic staff

Józef Modelski, Prof. D.Sc., Full Professor
Wojciech Wojtasiak, D.Sc., Associate Professor
Jacek Cichocki, Ph.D., Didactic Assistant Professor (0,5 till Sept. 2024, 0,4 from Oct.2024)
Vitomir Djaja-Jośko,Ph.D., Assistant Professor
Daniel Gryglewski, Ph.D., Assistant Professor
Wojciech Kazubski, Ph.D., Assistant Professor
Jerzy Kołakowski, Ph.D., Assistant Professor
Marcin Kołakowski, Ph.D., Assistant Professor
Przemysław Korpas, Ph.D., Assistant Professor
Sebastian Kozłowski, Ph.D., Assistant Professor
Karol Kuczyński, Ph.D., Assistant Professor (0,5)
Krzysztof Kurek, Ph.D., Assistant Professor
Przemysław Miazga, Ph.D. Didactic Assistant Professor
Mirosław Mikołajewski, Ph.D., Assistant Professor
Tomasz A. Miś, Ph.D., Assistant Professor (0,4 till Mar. 2024, 0,25 from Apr. 2024)
Dawid Rosołowski, Ph.D., Assistant Professor

Technical staff

Mirosław Lubiejewski, Foreman (0.5)

Ph.D. students

Łukasz Nowicki, M.Sc., from Oct. 2021
Marcin Wiśniewski, M.Sc., from Oct. 2021

Temporary Staff

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

Retired

Jan Ebert, Prof. D.Sc.,
Wojciech Gwarek, Prof. D.Sc.,
Stanisław Rosłoniec, Prof. D.Sc.
Tomasz Kosiło, Ph.D.,
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 embedded 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

Yevhen Yashchyshyn, Prof. D.Sc., Full Professor, (till Sept. ’24)
Paweł Kopyt, D.Sc., Associate Professor (from Oct. ‘24)
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Senior academic staff

Yevhen Yashchyshyn, Prof. D.Sc., Full Professor
Krzysztof Derzakowski, D.Sc., Associate Professor
Paweł Kopyt, D.Sc., Associate Professor
Bartłomiej Salski, D.Sc., Associate Professor
Paweł Bajurko, Ph.D., Assistant Professor
Grzegorz Bogdan, Ph.D., Assistant Professor
Konrad Godziszewski, Ph.D., Assistant Professor
Tomasz Karpisz, Ph.D., Assistant Professor till Jan. ’24
Adam Pacewicz, Ph.D., Assistant Professor, from Oct. 2024 (0,5, till Sep. 2024)
Jakub Sobolewski, Ph.D., Assistant Professor, from. Apr. 2023
Maciej Sypniewski, Ph.D., Didactic Assist. Professor (0.5)

Junior academic staff

Mateusz Krysicki, M.Sc., Research Assistant

Technical Staff

Adam Pacewicz, Ph.D., Senior R&D Engineer, (0,5)

Ph.D. students

Jerzy Cuper, M.Sc., from Oct. 2019, till Sep. 2024
Piotr Czekała, M.Sc., from Oct. 2021
Maciej Soszka, M.Sc., from Oct. 2018
Minyu Zhang, M. Sc., from Oct. 2023

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

Roman Z. Morawski, Prof. D.Sc., Full Professor (0.5)
Władysław Skarbek, Prof. D.Sc, Full Professor (0.5)
Grzegorz Pastuszak, D.Sc., Associate Professor
Kajetana Snopek, D.Sc., Associate Professor
Andrzej Buchowicz, Ph.D., Assistant Professor
Xin Chang, Ph.D., Assistant Professor
Grzegorz Galiński, Ph.D., Assistant Professor
Krystian Ignasiak, Ph.D., Didactic Assistant Professor
Paweł Mazurek , Ph.D., Assistant Professor
Jakub Wagner, Ph.D., Assistant Professor

Junior academic staff

Grzegorz Gwardys, M.Sc. , Assistant (0.5)

Technical staff

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

Ph.D. students

Michał Daniluk, M.Sc., from Oct. 2020
Szymon Kruszewski, M.Sc., from Oct. 2022
Daniel Mostowski, M.Sc., from Oct. 2020, till Sep. 2024

Retired
Andrzej Miękina, Ph.D.,
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

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

Secretariat

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1.5. Other Institute’s Units

1.5.1. Accounting Department

Head

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Staff

Zdzisława Fenikowska, M.A., Accounting Clerk
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Janina Nowak (em.), Senior Accounting Clerk
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e-mail: janina.nowak@pw.edu.pl

Beata Rosłon, Accounting Clerk
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1.5.2 Supply Section

Staff

Marcin Karpisz, M.Sc., Engineering and Technical Specialist (0.5)
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e-mail: marcin.karpisz@pw.edu.pl

Andrzej Laskowski, Worker
room: 419, phone: +48 22 2345018
e-mail: andrzej.laskowski@pw.edu.pl

Andrzej Owczarek, M.Sc., Maintenance Engineer (0.5), till Jul. 10, 2024
room: 419, phone: +48 22 2345018
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1.5.3 Office of the Foundation for the Development of Radiocommunication and Multimedia Technology

Anna Czarnecka, M.Sc., (em.), Research Suport Eng.
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2. STAFF

2.1. Senior academic staff

Paweł Bajurko
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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.
[Edu4], [Edu32], [Edu46], [Edu66], [Edu80], [Edu85], [Edu97], [Pro2], [Pro3], [Pro18], [Pro25], [Pro30], [MSc3].

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[Edu19], [Edu24], [Edu51], [Pro7], [MSc10], [MSc20], [BSc9], [BSc23], [BSc43], [BSc85], [BSc86], [BSc93], [BSc94], [BSc98], [Pub1], [Pub9], [Pub23], [Pub43], [Pub44], [Pub71].

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[Edu1], [Edu11], [Edu53], [Edu74], [Edu79], [Pro7], [BSc61], [Pub23].

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[Edu32], [Edu43], [Edu46], [Edu54], [Edu66], [Edu75], [Edu76], [Edu97], [Edu99], [Pro3], [Pro24], [Pro27], [Pro28], [Pub85].

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[Edu26], [Edu87], [Edu95], [Edu105], [Pro8], [MSc9], [MSc21], [MSc22], [Pub29].

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[Edu6], [Edu7], [Edu26], [Edu111].

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[Edu8], [Edu11], [Edu26], [Edu37], [Edu42], [Edu90], [Edu93], [Edu94], [Edu131], [Pro1], [Pro4], [Pro7], [Pro12], [BSc42], [Pub4], [Pub5], [Pub52].

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[Edu83], [Edu109], [Edu123], [Edu126], [Edu128], [BSc84].

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[Edu36], [Edu48], [Edu63], [Edu80], [Edu82], [Pro6], [Pub19].

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[Edu4], [Edu17], [Edu38], [Edu80], [Pub14], [Pub15].

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[Edu5], [Edu36], [Edu43], [Edu44], [Edu48], [Edu51], [Edu75], [Edu76], [Edu80], [Edu81], [Edu82], [Edu115], [Edu120], [Pro6], [MSc17], [BSc26], [BSc29], [BSc83], [Pub19], [Pub59], [Pub67].

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[Edu21], [Edu29], [Edu39], [Edu49], [Edu52], [Edu58], [Edu86], [Edu87], [Edu98], [Edu111], [Pro19], [MSc11], [MSc28], [BSc5], [BSc30], [BSc32], [BSc36], [BSc56], [BSc58], [BSc71], [BSc88], [BSc89], [Pub49], [Pat1].

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[Edu8], [Edu11], [Edu12], [Edu37], [Edu42], [Edu90], [Pro1], [Pro4], [Pro12], [BSc3], [BSc67], [BSc68], [Pub4], [Pub5], [Pub52].

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[Edu43], [Edu54], [Edu66], [Edu76], [Edu80], [Edu97], [Edu115], [Edu120], [Edu131], [Pro3], [BSc18], [BSc54], [Pub46], [Pub86].

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[Edu13], [Edu28], [Edu30], [Edu34], [Edu68], [Edu71], [Pro23], [Pub10], [Pub20], [Pub47].

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[Edu2], [Edu10], [Edu12], [Edu40], [Edu62], [Edu65], [Edu77], [Edu78], [Edu91], [BSc1], [BSc2], [BSc35], [BSc72], [BSc75], [BSc80], [BSc97].

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[Edu8], [Edu11], [Edu12], [Edu74], [Edu75], [Edu100], [Edu116], [Edu132], [Pro7].

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[Edu28], [Edu30], [Edu68], [Edu69], [Edu75], [Edu80], [Edu81], [Edu113], [BSc10], [BSc39].

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[Edu5], [Edu36], [Edu44], [Edu51], [Edu82], [Edu114], [Edu115], [Edu120], [Pro6], [BSc17], [BSc28], [BSc40], [BSc60], [BSc66], [Pub19], [Pub67].

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[Edu5], [Edu22], [Edu36], [Edu44], [Edu48], [Edu51], [Edu75], [Edu76], [Edu81], [Pro6], [BSc47], [Pub19], [Pub60], [Pub61], [Pub69].

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[Edu3], [Edu7], [Edu21], [Edu39], [Edu52], [Edu56], [Edu58], [Edu67], [Edu86], [Edu98].

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[Edu34], [Edu71], [Edu96], [Edu120], [Pro10], [Pub12], [Pub24], [Pub25], [Pub48], [Pub66], [Pub81], [Pub82].

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[Edu31], [Edu43], [Edu64], [Edu75], [Edu75], [Edu76], [Edu76], [Edu81], [Edu89], [Edu115], [Edu120], [Edu131], [Pub10], [Pub20], [Pub22], [Pub70].

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[Edu10], [Edu30], [Edu54], [Edu66], [Edu69], [Edu80], [Edu115], [Edu119], [Edu120], [BSc48], [Pub10], [Pub20], [Pub22].

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[Edu11], [Edu19], [Edu75], [Edu115], [Edu120], [BSc25], [BSc64], [BSc70], [BSc95], [BSc101], [Pub62], [Pub63].

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[Edu54], [Edu80], [Edu112], [Edu113], [Edu115], [Edu120], [Pro26], [Pro29].

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[Edu9], [Edu20], [Edu39], [Edu45], [Edu49], [Edu107], [Edu118], [Pro1], [Pro4], [Pro5], [MSc14], [MSc23], [MSc25], [BSc4], [BSc22], [BSc63], [BSc104], [Pub6], [Pub7].

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[Edu8], [Edu42], [Edu53], [Edu73], [Edu84], [Edu116], [Pro7], [BSc12], [BSc74], [BSc79], [Pub17], [Pub27], [Pub28].

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[Edu1], [Edu47], [Edu79], [Edu115], [Edu120], [BSc27], [Pat2].

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[Edu11], [Edu12], [Edu18], [Edu53], [Edu74], [Edu100], [Edu132], [Pro7].

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[Edu21], [Edu39], [Edu93], [Edu110], [Pro1], [Pro4], [Pub6], [Pub7].

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[Edu11], [Edu33], [Edu56], [Edu59], [Edu60], [Edu69], [Edu108], [Edu131], [Pro7], [BSc24], [BSc33], [BSc49], [BSc50], [BSc51], [BSc77], [Pub72].

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[Edu22], [Edu32], [Edu99], [Pub31].

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[Edu27], [Edu28], [Edu30], [Edu69], [Edu96].

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[Pub32], [Pub64], [Pub73], [Pub74], [Pub75].

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[Edu93], [Edu94], [BSc37], [Pub73], [Pub74], [Pub75].

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[Edu15], [Edu33], [Edu50], [Edu57], [Edu60], [Edu130], [Pro20], [Pub2], [Pub33], [Pub34], [Pub87].

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[Edu17], [Edu23], [Edu25], [Edu35].

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[Edu64], [Pub24], [Pub25], [Pub48], [Pub66], [Pub77].

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[Edu42], [Edu90], [Pro1], [Pro4], [Pro12], [Pub4], [Pub5], [Pub38], [Pub52].

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[Edu8], [Edu42], [Edu73], [Edu74], [Edu100], [Edu116], [Edu131], [Pro7], [Pro13], [Pro16], [BSc11], [BSc78], [BSc90], [BSc103], [Pub13], [Pub40], [Pub42], [Pub88], [Pub89], [Pub92], [Pub93].

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[Edu11], [Edu17], [Edu43], [Edu68], [Edu72], [Edu76], [Edu115], [Edu117], [Edu120], [Pub47].

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[Edu16], [Edu101], [Edu104], [Edu107], [Pro15], [MSc13], [BSc21], [BSc45], [BSc55], [BSc91], [BSc92], [Pub8], [Pub51].

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[Edu6], [Edu7], [Edu39], [Edu49], [Edu118], [Pro1], [Pro4], [Pro5], [MSc18], [MSc19], [MSc29], [BSc6], [BSc8], [BSc20], [BSc53], [BSc82], [Pub6], [Pub7], [Pub79].

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[Edu34], [Edu64], [Pro9], [Pub12], [Pub24], [Pub25], [Pub48], [Pub57], [Pub66], [Pub68], [Pub77], [Pub78], [Pub80], [Pub81], [Pub82].

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M.Sc. (‘72), Ph.D. (‘77), D.Sc. (‘94); Prof. Title (‘03); information technology, image processing, digital media; **Full Professor**.
Member of the Editorial Board of *Fundamenta Informaticae* (’03-), *International Journal of Electronics and Telecommunication* (’13-); Member of the Programme Committee of the National Conference of Radiocommunications and Broadcasting (’01).
[Edu83], [Edu92], [Edu106], [Edu121], [Edu122], [Edu123], [Edu124], [Edu125], [MSc4], [Pub50].

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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.
Head of the Laboratory of Information Acquisition and Processing Systems in the Nuclear and Medical Electronics Division (’15-); Member of the Faculty Council Committee on Education (‘16-); Member of the Scientific Council for Biomedical Engineering, WUT (’19, ’20-’24); Member of the Steering Committee - *Intelligent Decision Support System based on the Algorithmic Image Analysis in the Operations of the Justice System* - BIO10 Programme; Member of the Education Committee of the Council of the Faculty of Electronics and Information Technology; Member of the Scientific Council of the Discipline of Biomedical Engineering; Head of the field of study “Biomedical Engineering” at the Faculty of Electronics and Information Technology; Member of the WUT Doctoral School Council.
[Edu26], [Edu87], [Edu103], [MSc15], [BSc57], [Pub16], [Pub26], [Pub53], [Pub55], [Pat1].

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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-); Head of the Scholarship Commission of the Foundation for the Development of Radiocommunications and Multimedia Technology (’21-); Member of the Scientific Council for Technical Informatics and Telecommunications, WUT (’21-24); Member of the Steering Committee - *Intelligent Decision Support System based on the Algorithmic Image Analysis in the Operations of the Justice System* - BIO10 Programme (’20-22); Expert of the Telecommunications Section of KEiT PAS (’22-23); Member of the University Disciplinary Committee for Academic Teachers, WUT (2024-2028); Editor in chief (with W.Wojtasiak and G. Pastuszak) of Special Issue Electronics (mdpi) – “Wireless Communication and Multimedia Technology – Theory and Applications” (’22); Coordinator of the 5th edition of the Engineer 4 Science 2022 engineering diploma thesis competition at FEIT, WUT (Biomedical Engineering) (’22); Session Chair - *23rd Foundation Scholarship Holders Seminar;*
[Edu15], [Edu26], [Edu42], [Edu69], [Edu70], [Edu75], [Edu76], [MSc26], [BSc19], [BSc31], [Pub3].

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M.Sc. (‘16), Ph.D. (‘23); microwave technique; **Assistant Professor**, Sub-Terahertz Technology Division.
[Edu4], [Edu80], [Edu85], [Edu97], [Pro2], [Pro3], [Pro18], [Pro24].

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[Edu34], [Edu64], [Edu76], [Edu89].

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M.Sc. (‘11), Ph.D. (’20); measurement and instrumentation, **Assistant Professor**, Multimedia Engineering Division.
[Edu15], [Edu60], [Edu69], [MSc7], [MSc24], [BSc7], [BSc59], [BSc62], [Pub83].

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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); Member of the Scientific Council for Information and Communications Technology WUT (’20-’24).
[Edu26], [Edu28], [Edu68], [Edu115], [Pro23], [BSc34], [Pub10], [Pub20], [Pub22], [Pub37], [Pub47], [Pub76], [Pub84].

Damian Wanta
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M.Sc. (‘16), Ph.D. (’23); medical and nuclear engineering; **Assistant Professor**, Nuclear and Medical Electronics Division.
[Edu6], [Edu7], [Edu16], [Edu61], [Edu87], [Edu103], [Pro17], [Pro21], [Pub16], [Pub26], [Pub53], [Pat1].

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M.Sc. (‘79), Ph.D. (‘86), D.Sc. (‘06), Prof. Title (’16); telecommunications and electronics; **Full Professor**, Sub-Terahertz Technology Division.
Head of Division (’20-24), Deputy Director for Research (’24-), Senior Member of IEEE (’10-); Member of the Committee on Electronics and Telecommunications PAN (‘19-24); Member of the TPC of the International Conferences: TCSET (‘98-) , CADSM (‘00-) , IMNE (‘2018 -) ; Reviewer of the IEEE Trans. on MTT (‘04-), IEEE Trans on AP (‘06-) and IEEE Microwave and Wireless Components Letters (‘04-); Member of Editorial Board and Reviewer of Radioelectronics and Communications Systems (‘09-); Member of the Microwave and Radiolocation Section of the Electronics and Telecommunication Committee of the PAN (‘07-); Member of the Programme Committee of the National Conference of Radiocommunications and Broadcasting (‘09-); Member of the Faculty Council (’16-); Member of the Scientific Council of the Discipline of Automatic Control, Electronics, Electrical Engineering and Space Technologies, WUT (’19, ’20-’24).
[Edu4], [Edu80], [Edu85], [Edu93], [Edu97], [Pro2], [Pro3], [MSc2], [MSc8], [BSc73], [Pub30], [Pub39], [Pub46], [Pub54], [Pub56], [Pub85], [Pub86].

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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-); Nuclear and Medical Electronics Division.
Member of CERN (‘89-); 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 Automotive Industry Institute (‘17-); Member of the Scientific Board of the Institute of the Nuclear Chemistry and Technology (‘17-); Member of the Scientif. Council for Automatic Control, Electronics and Electrical Engineering, WUT (’19-); Head of the Committee on Education, the Conf. of Rectors of Academic Schools in Poland, (’20-); Member of the Plan for Work and Development Council (21-).
[Pro1], [Pro4], [Pro5], [Pub6], [Pub7].

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M.Sc. (‘02), Ph.D. (’20); nuclear and medical electronics; **Assistant Professor**, Nuclear and Medical Electronics Division.
[Edu21], [Edu29], [Edu39], [Edu49], [Pro1], [Pro4], [Pro5], [Pro14], [MSc16], [Pub6], [Pub7], [Pub52].

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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-), Audio Engineering Society (’11), Member of the Technical Committees of the Polish Committee for Standardization (’09-); Vice-President of the Scientific Council of Central Institute for Labour Protection – National Research Institute (’21-), Member of Editorial Board of Archives of Acoustics.
[Edu55], [Edu102], [Edu130], [MSc5], [MSc6], [Pub58].

2.2. Junior academic staff

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

Ph.D. Student	**(tutor)**
Dina Al.-Daloo, M.Sc.	*(P. Bilski)*
Piotr Czekała, M.Sc.	*(B.Salski)*
Piotr Czarnecki, M.Sc. *)	*(P. Bilski)*
Michał Daniluk, M.Sc.*)	*(G. Pastuszak)*
Krzysztof Dygnarowicz, M.Sc.	*(J. Marzec)*
Salomea Grodzicka, M.Sc.	*(P. Bilski)*
Ary Kurniadi Irawan, M.Sc.	*(P. Bilski)*
Mikhail Ivanenko, M.Sc.	*(W. Smolik)*
Bartosz Kościug, M.Sc.	*(P. Bilski)*
Szymon Kruszewski, M.Sc.	*(R. Z. Morawski)*
Kamil Lipiński, M.Sc.	*(P. Bogorodzki)*
Tomasz Markowski, M. Sc.*)	(*P. Bilski)*
Mateusz Midura, M.Sc.	(*W. Smolik)*
Łukasz Nowicki, M.Sc. *)	*(W. Wojtasiak)*
Michał Nurek , M.Sc.	(J. Marzec)
Katarzyna Orzechowska, M.Sc.	*(K. Zaremba)*
Karolina Pondel-Sycz, M.Sc.	*(P. Bilski)*
Bartosz Połok, M.Sc.	(*P. Bilski)*
Łukasz Popek, M.Sc. *)	(P. Bilski)
Maciej Soszka, M.Sc.*)	*(Y. Yashchyshyn)*

Jakub Tkaczuk, M.Sc. *) (*P. Bilski)*
Marcin Wiśniewski, M.Sc. *) *(W.Wojtasiak)*
Przemysław Wróblewski, M.Sc. (*W. Smolik)*
Minyu Zhang, M. Sc. (*Y. Yashchyshyn)*
*) implementation doctorate

2.4. Technical and administrative staff

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Aleksandra Jefimowicz, M.A.,. Accounting Clerk
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Dariusz Kołodziej, M.Sc., Research Support Eng.
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Tomasz Krzymień, M.Sc., Administrative Clerk for Health and Safety
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Andrzej Laskowski, Worker
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Mirosław Lubiejewski, Foreman (0.5)
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Tomasz Olszewski, R&D Engineer (0.5)
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Marta Rudnicka, Senior Administrative Clerk
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Anna Smenda, Administrative Clerk
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Andrzej Wasilewski, Worker
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3. TEACHING ACTIVITIES

(the summer semester of the academic year 2023/2024 and the winter semester of the academic year 2024/2025)

3.1. Regular studies – main fields of study:

Electronics

Specialization: Electronics and Computer Science in Medicine

Head

Andrzej Rychter, Ph.D., Assistant Professor
room: 64, phone: +48 22 2347916
e-mail: andrzej.rychter@pw.edu.pl

Informatics

Specialization: Computer Science in Multimedia

Head

Grzegorz Pastuszak, D.Sc., Associate Professor
room: 451, phone: +48 22 2347840
e-mail: grzegorz.pastuszak@pw.edu.pl

Biomedical Engineering

Specialization: Biomedical Apparatus

Head

Grzegorz Domański, Ph.D., Assistant Professor
room: 61, phone: +48 22 2347626
e-mail: grzegorz.domanski@pw.edu.pl

Specialization: Biomedical Information Technology

Head

Tymon Rubel, Ph.D., Assistant Professor
room: 5, phone: +48 22 2347739
e-mail: tymon.rubel@pw.edu.pl

Telecomunications

Specialization:

- **Wireless and Multimedia Technologies (I^0 studies)**

Head

Konrad Godziszewski, Ph.D., Assistant Professor
room: 35, phone: +48 22 2347796
e-mail: konrad.godziszewski@pw.edu.pl

Specialization:

- **Wireless and Multimedia Techniques (II^0 studies)**

Andrzej Buchowicz, Ph.D., Assistant Prof.
room: 451, phone: +48 22 2347840
e-mail: andrzej.buchowicz@pw.edu.pl

3.1.1. Basic courses

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

[Edu2] *Algorithms and Programming 1* (Algorytmy i programowanie 1 - APRO1); 30 h/sem.; K. Ignasiak (Faculty coordinator: the Institute of Telecommunications).

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

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

[Edu5] *Basics of Cellular Systems* (Podstawy systemów komórkowych – PSK); 45h/sem.; J. Kołakowski.

[Edu6] *Basics of Medical Imaging* (Podstawy obrazowania medycznego – POMED); 45 h/sem.; P. Brzeski.

[Edu7] *Basics of Medical Imaging Techniques* (Podstawy technik obrazowania w medycynie – PTOM); 60 h/sem.; P. Brzeski.

[Edu8] *Basics of Multimedia* (Podstawy multimediów – PMUT); 43 h/sem.; A. Buchowicz.

[Edu9] *Basics of Programming* (Podstawy programowania – PPR); 60 h/sem.; R. Kurjata.

[Edu10] *Basics of Programming* (Podstawy programowania – POPRO); 30 h/sem.; K. Ignasiak, S. Kozłowski (Faculty coordinator: the Institute of Telecommunications).

[Edu11] *Basics of Programming 1* (Podstawy programowania 1 – PRM1T); 60 h/sem.; A. Buchowicz.

[Edu12] *Basics of Programming 2* (Podstawy programowania 2 – PRM2T); 55 h/sem.; K. Ignasiak.

[Edu13] *Basics of Radiolocation and Radionavigation* (Podstawy radiolokacji i radionawigacji – PRIR); 45 h/sem; D. Gryglewski.

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

[Edu15] *Computing in Engineering* (Obliczenia inżynierskie – OINT); 30 h/sem.; R. Z. Morawski.

[Edu16] *Computer Graphics* (Grafika komputerowa – GRK); 30 h/sem.; T. Rubel.

[Edu17] *Computer Systems: Architecture and Programming* (Systemy komputerowe: architektura i programowanie - SYKOM); 60h/sem.; K. Derzakowski, K. Mroczek, D. Rosołowski (Faculty coordinator: the Institute of Telecommunications).

[Edu18] *Construction of High Quality Audio Equipment* (Konstrukcja urządzeń audio wysokiej jakości – KUA); 45 h/sem.; G. Makarewicz.

[Edu19] *Data Analysis Methods* (Metody analizy danych – MADAN; 80h/sem.; P. Bilski.

[Edu20] *Data Security in Medical Information Systems* (Bezpieczeństwo medycznych systemów informacyjnych – BEMSI); 45 h/sem.; R. Kurjata.

[Edu21] *Detection of Ionizing Radiation* (Detekcja promieniowania jonizującego - DEPJO); 30 h/sem.; J. Marzec.

[Edu22] *Digital Circuits* – EDC1; 60 h/sem.; P. Miazga (English-medium studies).

[Edu23] *Digital Circuits* (Technika cyfrowa – TECY),

30 h/sem.; K. Mroczek (Faculty coordinator: the Institute of Telecommunications).

[Edu24] *Digital Communications* – EDICO; 60 h/sem.; P. Bilski (English-medium studies).

[Edu25] *Digital Systems* (Systemy cyfrowe – SYCYF), 30 h/sem.; K. Mroczek (Faculty coordinator: the Institute of Telecommunications).

[Edu26] *Diploma Seminar for Undergraduate Students* (Seminarium dyplomowe inżynierskie – SDI); 30 h/sem.; A. Buchowicz.

[Edu27] *DC/DC Power Converters Supply* (Zasilanie układów elektronicznych - ZUE); 45 h/sem.; M. Mikołajewski.

[Edu28] *Electronic Circuits* (Układy elektroniczne – ULET); 60h/sem.; W. Wojtasiak.

[Edu29] *Electronic Circuits* (Układy elektroniczne – UEL); 60 h/sem.; W. Obrębski.

[Edu30] *Electronic Circuits and Systems* (Elementy i układy elektroniczne – UKEL); 60 h/sem.; D. Gryglewski.

[Edu31] *Embedded Systems Software Architecture* (Architektura oprogramowania w systemach wbudowanych – AOSYW); 30 h/sem.; P. Korpas (Faculty coordinator: the Institute of Microelectronics and Optoelectronics).

[Edu32] *Evolutionary Algorithms* (Algorytmy ewolucyjne – AE); 45 h/sem.; G. Bogdan, P. Miazga.

[Edu33] *Ethical Aspects of Research and Engineering* – EEARE; 30 h/sem; R. Z. Morawski, (English-medium studies).

[Edu34] *Fields and Waves* (Pola i fale – POFAT); 56 h/sem.; B. Salski.

[Edu35] *Fundamentals of Digital Technology* (Podstawy techniki cyfrowej – PTCY); 30 h/sem.; K. Mroczek (Faculty coordinator: the Institute of Computer Science).

[Edu36] *Fundamentals of Wireless Communication* (Podstawy transmisji bezprzewodowej – PTB); 57 h/sem.; J. Kołakowski.

[Edu37] *Image Techniques* (Technika obrazowa- TO); 60 h/sem.; G. Galiński.

[Edu38] *Influence of Electromagnetic Waves on Living Organisms* (Oddziaływanie fal elektromagnetycznych na organizmy żywe – OFE); 30 h/sem.; K. Derzakowski.

[Edu39] *Ionizing radiation detectors* (Detektory promieniowania jonizującego – DETPJ); 60h/sem.; J. Marzec.

[Edu40] *Internet of Things Services and Applications* (Usługi i aplikacje internetu rzeczy – PBL5); 120 h/sem.; K. Ignasiak (Faculty coordinator: the Institute of Telecommunications).

[Edu41] *Introduction to Medical Science* (Wprowadzenie do nauk medycznych – WNM); 45 h/sem.; R. Jóźwiak.

[Edu42] *Introduction to Multimedia* (Wstęp do multimediów – WMM); 72 h/sem.; G. Pastuszak.

[Edu43] *Introduction to Telecommunications* (Wprowadzenie do telekomunikacji – WDT); 33 h/sem.; G. Bogdan, V. Djaja-Jośko, K. Godziszewski, P. Korpas, D. Rosołowski (Faculty coordinator: the Institute of Telecommunications).

[Edu44] *IoT Radio Interfaces* (Interfejsy radiowe systemów internetu rzeczy – IRI); 45 h/sem.; J. Kołakowski.

[Edu45] *IoT Systems in Healthcare* (Urządzenia IoT w opiece medycznej – UIOM); 45h/sem.; R. Kurjata.

[Edu46] *Localization and Identification Systems* (Systemy lokalizacji i identyfikacji – SLID); 60 h/sem.; P. Bajurko.

[Edu47] *Measurement Systems* (Systemy pomiarowe – SPOM); 60 h/sem.; R. Łukaszewski.

[Edu48] *Measurements in Radio Electronics* (Pomiary w radioelektronice – POR); 45h/sem.; J. Cichocki.

[Edu49] *Medical Electronic Instrumentation* (Elektroniczna aparatura medyczna – EAME); 60 h/sem.; A. Rychter.

[Edu50] *Methodical Aspects of Engineering* (Metodyczne aspekty działalności inżyniera – MADI); 30 h/sem; R. Z. Morawski (Institute of Telecommunications).

[Edu51] *Microcontrollers and Programmable Circuits* (Mikrokontrolery i układy programowalne – MUP); 60h/sem.; P. Bilski.

[Edu52] *Microprocessor Technique* (Technika mikroprocesorowa – TEMI); 45 h/sem.; G. Domański.

[Edu53] *Multimedia applications* (Aplikacje multimedialne – APEM); 54h/sem.; P. Bobiński.

[Edu54] *Multi-service and Multimedia Networks* – EMSMN; 60 h/sem.; S. Kozłowski (English--medium studies).

[Edu55] *Musical Acoustics* (Akustyka muzyczna – AM); 45 h/sem.; J. Żera.

[Edu56] *Neural Networks in Biomedical Applications* (Sieci neuronowe w zastosowaniach biomedycznych – SNB), 45 h/sem.; P. Mazurek.

[Edu57] *Non-technical Aspects of Engineering* (Pozatechniczne aspekty pracy inżyniera – PAPIN); 44 h/sem.; R. Morawski (coordinator: Faculty of Administration and Social Sciences and Institute of Telecommunications).

[Edu58] *Nuclear Medicine Techniques* (Techniki medycyny nuklearnej – TMENU); 30 h/sem.; G. Domański.

[Edu59] *Numerical Methods* (Metody numeryczne – MNUB); 45 h/sem.; P. Mazurek.

[Edu60] *Numerical Methods* – ENUME; 60 h/sem.; R. Z. Morawski, (English-medium studies).

[Edu61] *Object-oriented Programming* (Programowanie obiektowe – PROBI); 60 h/sem.; D. Wanta.

[Edu62] *Object-oriented Programming of Multimedia*

*Applications in Java (*Java – obiektowe programowanie aplikacji multimedialnych – OPA); 45 h/sem.; K. Ignasiak.

[Edu63] *Orientation* (Orientacja - ORIT); 8 h/sem.; J. Cichocki.

[Edu64] *Physics 2* – EPHY2; 60 h/sem.; B. Salski, (English-medium studies).

[Edu65] *Programming of Geoinformation Applications* (Programowanie aplikacji geoinformacyjnych – ISP); 30 /sem.; K. Ignasiak (for Faculty of Geodesy and Cartography).

[Edu66] *Radio Transmission* (Transmisja radiowa – TRRA); 57 h/sem.; K. Godziszewski.

[Edu67] *Radiology and Nucleonics* (Radiologia z nukleoniką – RN); 45 h/sem;. B. Konarzewski.

[Edu68] *RF & Microwave Engineering in Telecommunications* (Technika mikrofalowa w telekomunikacji – TMT); 45 h/sem.; W. Wojtasiak.

[Edu69] *Signals and Systems* (Sygnały i systemy – SYGSY); 60 h/sem.; K. Snopek.

[Edu70] *Signals and Systems* (Sygnały i systemy – SYSE); 33 h/sem.; K. Snopek (Faculty coordinator: the Institute of Electronic Systems).

[Edu71] Simulation of Radioelectronic Circuits (Symulacja układów radioelektronicznych - SUREL); 45 h/sem.; D. Gryglewski.

[Edu72] *Software Defined Radio in Telecommunications* (Radio programowalne w telekomunikacji – RAPT); 48h/sem.; D. Rosołowski.

[Edu73] *Sound Recording Technique* (Dźwiękowa technika studyjna – DTS); 42 h/sem.; M. Lewandowski.

[Edu74] *Sound Technique* (Technika dźwiękowa – TD); 45 h/sem.; P. Bobiński.

[Edu75] *Team Project 1* (Projekt grupowy 1 – PROJ1); 13 h/sem.; P. Korpas.

[Edu76] *Team Project 2* (Projekt grupowy 2 – PROJ2); 30 h/sem.; P. Korpas.

[Edu77] *Team Project 2* (Projekt zespołowy 2 - PZSP2); 60 h/sem.; K. Ignasiak (Faculty coordinator: the Institute of Control and Computation Engineering).

[Edu78] *User Interface Design* (Projektowanie interfejsu użytkownika – PIU); 45 h/sem.; K. Ignasiak.

[Edu79] *Web Applications* (Programowanie aplikacji internetowych – PAINT); 45 h/sem.; R. Łukaszewski.

[Edu80] *Wireless Transmission and Antennas* (Transmisja bezprzewodowa i anteny – TBAT); 60 h/sem.; K. Godziszewski.

[Edu81] *Wired and Wireless Communication* (Komunikacja przewodowa i bezprzewodowa – PBL3); 180h/sem.; P. Korpas.

[Edu82] *4th and 5th Generation Cellular Systems* (Systemy komórkowe 4 i 5 generacji – SYK45); 45h/sem.; J. Kołakowski.

3.1.2. Advanced courses

[Edu83] *Adaptive Image Recognition* – EADIR; 60 h/sem.; W. Skarbek (English-medium studies).

[Edu84] *Advanced Multimedia Signal Processing* (Zaawansowane przetwarzanie danych multimedialnych – ZPDM); 60 h/sem.; M. Lewandowski.

[Edu85] *Antennas* (Anteny – EANTE); 54 h/sem.; Y. Yashchyshyn (English-medium studies).

[Edu86] *Biostatistics* (Biostatystyka – BST); 45 h/sem.; Z. Wawrzyniak.

[Edu87] *Computed Tomography* (Tomografia komputerowa – TOM); 60 h/sem.; W. Smolik.

[Edu88] *Computer - Aided Medical Image Diagnostics* (Komputerowe wspomaganie obrazowej diagnostyki medycznej – KWOD); 45 h/sem.; A. Przelaskowski.

[Edu89] *Computional Electromagnetics for Telecommunications* – ECOET; 60 h/sem.; P. Korpas (English-medium studies).

[Edu90] *Data Compression* (Kompresja danych – KODA); 45 h/sem.; G. Pastuszak.

[Edu91] *Data Science Product Management* (Zarządzanie produktami data science – ZPDS); 45h/sem.; G. Gwardys.

[Edu92] *Deep Neural Networks for Digital Media* (Głębokie sieci neuronowe w mediach cyfrowych – GSN); 60 h/sem.; W. Skarbek.

[Edu93] *Diploma Seminar for Graduate Students 1* (Seminarium dyplomowe magisterskie 1 – SDM1); 30 h/sem.; A. Buchowicz.

[Edu94] *Diploma Seminar for Graduate Students 2* (Seminarium dyplomowe magisterskie 2 – SDM2); 30 h/sem.; A. Buchowicz.

[Edu95] *Dynamic Medical Image Data Analysis* (Analiza medycznych obrazowych danych dynamicznych – AMDD); 45 h/sem.; P. Bogorodzki.

[Edu96] *Electromagnetic Compatibility* – EEMC; 45 h/sem.; P. Kopyt (English-medium studies).

[Edu97] *Electronic devices of wireless systems* (Układy systemów bezprzewodowych – USYB); 60h/sem.; Y. Yashchyshyn.

[Edu98] *Embedded Programming for Medical Devices* (Programowanie wbudowane w urządzeniach medycznych – PWUM); 45 h/sem.; G. Domański.

[Edu99] *Evolutionary Algorithms* – EEVAL; 60h/sem.; P. Miazga.

[Edu100] Fundamentals of Acoustics and Electroacoustics (Podstawy akustyki i elektroakustyki - PAE); 45 h/sem.; M. Jasiński.

[Edu101] *Genetic Engineering* (Inżynieria genetyczna – INGE); 15 h/sem.; T. Rubel.

[Edu102] *Hearing and Sound Perception* (Słyszenie i percepcja dźwięku – SPD); 45 h/sem.;

J. Żera.

[Edu103] *Information Sytems in Medicine* (Systemy informatyczne w medycynie – SIM); 60 h/sem.; W. Smolik.

[Edu104] *Machine Learning in Bioinformatics* (Uczenie maszynowe w bioinformatyce – UMB); 60 h/sem.; T. Rubel.

[Edu105] *Magnetic Resonance Imaging* (Tomografia rezonansu magnetycznego – TRM); 45 h/sem.; P. Bogorodzki.

[Edu106] *Mathematics in Multimedia* (Matematyka w multimediach – MATMU); 60 h/sem.; W. Skarbek.

[Edu107] *Medical IT Systems* (Informatyczne systemy medyczne – ISMED); 45 h/sem.; R. Kurjata.

[Edu108] *Methodological and Ethical Issues of Technoscientific Research – EMET;* 30h/sem.; P. Mazurek (English-medium studies).

[Edu109] *Neural Network Compression with Applications* – ENNCA; 60h/sem.; X.Chang (English-medium studies).

[Edu110] *Noise and Electromagnetic Interference in Electronic Devices* (Szumy i zakłócenia w aparaturze elektronicznej – SZAE); 45 h/sem., J. Marzec.

[Edu111] *Nuclear Medicine Techniques* (Techniki medycyny nuklearnej – TMN); 60 h/sem.; G. Domański.

[Edu112] *Radiocommunication System Design* (Projektowanie systemów radiokomunikacyjnych – PSRK); 60 h/sem.; K. Kurek.

[Edu113] *Satellite Communications* (Łączność satelitarna – LS); 45 h/sem.; K. Kurek.

[Edu114] *Security of 5G and 6G Networks* (Bezpieczeństwo sieci 5G i 6G – BESG); 45 h/sem.; J. Kołakowski (Faculty coordinator: the Institute of Telecommunications).

[Edu115] *Security of the Internet of Things* (Bezpieczeństwo internetu rzeczy – BIR); 180h/sem.; W. Wojtasiak.

[Edu116] *Spatial Audio System* (Systemy dźwięku przestrzennego – SDP); 60 h/sem.; M. Lewandowski, A. Pietrzak.

[Edu117] *SRD Technology in Applications* (Techniki radia programowalnego w zastosowaniach – TRPZ), 60 h/sem.; D. Rosołowski.

[Edu118] *Telemedical Systems* (Systemy telemedyczne - TELM); 60 h/sem.; R. Kurjata.

[Edu119] *Wideband Transmission in Radio Systems* (Transmisja szerokopasmowa w systemach radiowych – TSSR); 60 h/sem.; S. Kozłowski;

[Edu120] *Wireless Security* (Bezpieczeństwo komunikacji bezprzewodowej – BEKO); 180 h/sem.; D. Rosołowski.

3.2. Special courses

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

[Edu121] *2D/3D Modeling* (Modelowanie 2D/3D); W. Skarbek, G. Gwardys.

[Edu122] *Data Security and Neural Models* (Bezpieczeństwo Danych i Modeli Neuronowych); W. Skarbek, J. Komorowski.

[Edu123] *Deep Neural Networks-Basics* (Głębokie sieci neuronowe – podstawy); W. Skarbek, X. Chang.

[Edu124] *Digital Media and Model Compression* (Kompresja Mediów Cyfrowych i Modeli); W. Skarbek.

[Edu125] *Digital Objects Indexing* (Indeksowanie obiektów cyfrowych); W. Skarbek, G. Gwardys, J. Komorowski.

[Edu126] *Digital Objects Recognition* (Rozpoznawanie obiektów cyfrowych); P. Cyrta, X. Chang, J. Komorowski.

[Edu127] *Great Language Models and Their Applications* (Wielkie Modele Językowe i Ich Zastosowania); G. Gwardys, J. Komorowski.

[Edu128] *New Trends in Neural Modeling* (Nowe Trendy w Modelowaniu Neuronowym); G. Gwardys, X. Chang, P. Cyrta.

[Edu129] *Programming deep neural networks* (Programowanie głębokich sieci neuronowych); G. Gwardys, D. Gronkiewicz.

3.3. International co-operation

[Edu130] Within the Advanced Technology Higher Education Network / Socrates (ATHENS), the course "*Ethical Aspects of Research and Engineering*" was given by **Roman Z. Morawsk**i, and the course “*Sound: Hearing and Acoustical Measurements*” was given by **Jan Żera**. The students who attended these courses were from the following EU institutions of higher education:

- Chimie ParisTech (France) – 3 persons;
- École des Ponts ParisTech (France) – 3 persons;
- Telecom ParisTech (France) – 6 persons;
- Mines Paris-PSL (France) – 1 person;
- České vysoké učení technické v Praze (Czechia) – 4 persons;
- Instituto Superior Técnico (Lisbon, Portugal) – 7 persons;
- Norges Teknisk-Naturvitenskapelige Universitet (Trondheim, Norway) – 1 person;
- İstanbul Teknik Üniversitesi (Turkey) – 2 persons;
- Katholieke Universiteit Leuven (Belgium) – 2 persons;
- Politecnico di Milano (Italy) – 8 persons;
- Technische Universität München (Germany) – 5 persons;
- Technische Universiteit Delft (Netherlands) – 6 persons;
- Universidad Politécnica de Madrid (Spain) – 4 persons;

– Universitatea Politehnica din București (Romania) – 1 person.

3.4. Educational projects

[Edu131] **OMNIS2 "Open. Modern. New. Integrated. Social"** (OMNIS2 "Otwartość. Modernizacja. Nowoczesność. Integracja. Społeczność").
Andrzej Buchowicz, A. P. Pietrzak, K. Godziszewski, P. Korpas, P. Mazurek;
May 01, 2024 – Jun. 30, 2029
Funded by the National Centre for Research and Development

The goal of the project "OMNIS2 Open. Modern. New. Integrated. Social." is to adapt the teaching offer of Warsaw University of Technology to the needs of the labor market, as well as to strengthen the competitiveness of the University's graduates.
The scope of the project includes 14 substantive tasks related to adapting or rationalizing the offer of first-cycle studies, new solutions in the field of education in second-cycle studies, pilot implementation of uniform master's studies and expanding the offer of studies in English. One central task was also planned in terms of improving the competences of teaching staff.
Each task implemented by the selected Faculties includes a package of activities: (1) modification of educational programs in cooperation with practitioners and entities from the socio-economic environment; (2) additional elements of education - trainings/courses, additional classes conducted by industry specialists, study visits for students; (3) activities to reduce dropout - compensatory classes for students, activities leading to recruitment of informed candidates; (4) raising the competence of teaching staff in digital competence, development of awareness and skills for green transformation, but also teaching competence, including the use of modern teaching methods.
The changes will include the majors: technical physics, geodesy and cartography, mechatronics, automation, robotics and industrial computer science, telecommunications, internet of things engineering, biomedical engineering, papermaking and printing, civil engineering, applied computer science, spatial planning.
Nine Faculties of the Warsaw University of Technology are implementing the project: Physics, Geodesy and Cartography, Mechatronics, Civil Engineering, Mechanics and Petrochemistry, Electronics and Information Technology, Mechanical and Industrial Engineering, Civil Engineering, Electrical Engineering, and the College of Economics and Social Sciences in Plock.

3.5. Noise Control Study

[Edu132] **E. Kotarbińska, M. Jasiński, G. Makarewicz. J. Witkowska**
Feb. 03, 2024 – May 26, 2024

The Noise Control Study covered key aspects of noise protection in both external environment and workplaces. The program was designed for profes-sionals responsible for environmental protection, employees of environmental laboratories, acoustic consultants, and workplace safety personnel.

The course was conducted by academic staff from the Warsaw University of Technology, as well as experts from other universities, research institutes, and industry professionals specializing in noise measurement, acoustic modelling, noise control solutions, and legal regulations related to noise pro-tection.

The study followed a blended learning approach. Lectures were held online, while practical workshops took place during in-person weekend sessions at the Warsaw University of Technology.

The total duration of the program was 105 hours, divided into seven weekend sessions, combining remote lectures with hands-on workshops. This was the 10th edition of the course, initiated by Ewa Ko-tarbińska, PhD.

4. RESEARCH ACTIVITIES

4.1. International projects

[Pro1] **Super-Kamiokande to Hyper-Kamiokande (SK2HK)**
Marcin Ziembicki, J. Marzec, K. Zaremba, A. Rychter, R. Kurjata, K. Dygnarowicz, W. Obrębski, G. Pastuszak, A. Buchowicz, G. Galiński;
Nov. 01, 2019 – Apr. 30, 2025
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] **Innovation 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 - Jul 31, 2024
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.

[Pro3] **Novel Technologies and Materials for TeraHertz Radiation Control** (Nowoczesne technologie i materiały do kontroli promieniowania terahertzowego).
Yevhen Yashchyshyn, P. Bajurko, K. Godziszewski, G. Bogdan, J. Sobolewski
Jan. 01, 2023 – Jun. 30, 2028
TeraHertz, Horizon Europe EU Framework Programme, **MSCA Staff Exchanges Action**

The project focuses on developing novel technologies and materials characterization that are to be used synergistically to create advanced possibilities for terahertz radiation control. International team expertized in materials synthesis and terahertz science will
direct its efforts towards the development of innovative quasi-optical technologies which will help finding the solution for efficient use of dielectric and semiconductor crystalline materials, including nanocomposites and coplanar structures, and their application as
functional elements in terahertz radiation control devices, ultimately targeting market-ready innovative products. A range of such materials will be considered for thorough investigations of potential application in electro/acousto-quasioptical devices to control THz radiation. Optimization of transmission, absorption, refraction indexes, loss tangent, the dielectric constant will be made based on experimental measurements and computer simulations. The project's scope will include semiconductor materials in which lightinduced photogeneration of charge carriers is possible. The effect of photogeneration on the parameters of these materials will be used to develop efficient quasi-optical cells, which are key elements of control devices. The project brings together an international multidisciplinary network of organizations from academia and industry that will work coherently on the innovative research program on quasi-optical technologies and related material engineering. Participants will exchange skills and share knowledge, strengthening links between countries and promoting interaction between involved economics sectors. Reaching the goals related to the implementation of advanced quas i-optical technologies will open new market possibilities for engaged non-academic project participants, ultimately becoming beneficial for European society globally.

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

4.2.1. International grants

[Pro4] **Hyper-Kamiokande (HK)**
Marcin Ziembicki, **Andrzej Rychter**, J.Marzec, K.Zaremba, R.Kurjata, K.Dygnarowicz, W.Obrębski, G.Pastuszak, A.Buchowicz, G.Galiński;
Dec. 01, 2022 – Nov. 30, 2027

Programme: **"Support for the participation of Polish research teams in international research infrastructure projects".**

Hyper-Kamiokande is a next-generation neutrino experiment currently under construction in Japan and scheduled to launch in 2027. One of the key components of this experiment will be two new underground water detectors of Cherenkov radiation: a far detector with a mass of 250 kt (the world's largest man-made object of this type) and an intermediate detector. The physics program of the Hyper-Kamiokande experiment will address the most important unsolved issues in physics, such as the violation of charge-space symmetry of CP in neutrino oscillations and the decay of nucleons. The WUT team is responsible for the preparation of multi-PMT photodetection modules, which consist of 19 3-inch photomultipliers, high-voltage power supply systems and readout electronics, and the whole is enclosed in a pressurized housing. These modules are being developed together with partners from Italy, Canada, Japan, the Czech Republic and Mexico. The project also includes a test experiment at CERN (Water Cherenkov Test Experiment), which is scheduled to be launched in 2024

[Pro5] **T2K experiment (Tokai-to-Kamioka)** (Eksperyment T2K) (Tokai-to-Kamioka).
Andrzej Rychter, K. Zaremba, R. Kurjata, M. Ziembicki, K. Dygnarowicz
2023/WK/04, International project is realized in collaboration with the National Center for Nuclear Research, Department Basic Research BP3, University of Warsaw, Faculty of Physics University of Silesia in Katowice, Faculty of Science and Technology, University of Wrocław, Faculty of Physics, Institute of Nuclear Physics of the Polish Academy of Sciences;
Mar. 01, 2023 – Dec. 31, 2027
Funded by the Ministry of Science and Higher Education

This application concerns the participation of Polish groups in the T2K experiment in the period March 1, 2023 - December 31, 2027 and is a continuation of the project for financing participation in this experiment in the period October 1, 2017 - September 30, 2022. Further participation in the T2K experiment will be carried out in parallel with the construction of the Hyper-Kamiokande detector. The tasks to be carried out in the submitted application are related to supporting the participation of Polish groups in measurements carried out in the T2K experiment as research infrastructure.

[Pro6] **Integrated Care Platform Based on the Monitoring of Older Individual Intrinsic Capacity for Inclusive Health (CAREUP)** (Zintegrowana platforma inkluzywnej opieki nad osobami starszymi oparta na monitorowaniu zdolności wewnętrznych).
Jerzy Kołakowski, V. Djaja-Jośko, M. Kołakowski, J. Cichocki
May, 1, 2022 – Nov. 30, 2024
Ambient Assisted Living (AAL)
Funded by the National Centre for Research and Development

The CAREUP project objective is to design and implement an ICT platform to preserve older adults' intrinsic capacity and functional ability through continuous monitoring and application of preventive measures. To do so, CAREUP will compensate for their decline (due to aging) through the development of a customized and personalized care plan with multi-component interventions whose implementation focuses on the fulfillment of the person-centered goals, uses principles of self-management support, community engagement, caregiver support and shared decision making with support caregivers.

[Pro7] **Intelligent speech processing system for doctors** (Inteligentny system przetwarzania mowy dla lekarzy).
Piotr Bilski; A. Buchowicz, P. Bobiński, P. Gawrysiak, M. Jasiński, M. Lewandowski, G. Makarewicz, P. Mazurek, A. P. Pietrzak;
Mar. 01, 2023 – Nov. 30, 2025
INFOSTRATEG IV
Funded by the National Centre for Research and Development

The aim of the project will be to develop tools for speech processing (consisting of phrases spoken by the doctor and possibly the patient) and exctracting relevant infromation from the text which will be then be classifield semantically in order to, for example define the topic of the conversation and the diagnosis. Critical technologies to be developed in the project will include artifical intelligence methods for Natural Language Processing (NLP): extracting words from the record audio stream (so-called text to speech) and semantic analysis of the extracted text using deep natural networks. The results of the processing will be output to the forms and databases developed for this purpose. The former will be flexible, so that they can be able to automatically generate documents: prescriptions, exemptions or referrals for further diagnostic tests.

4.2.2. Research grants

[Pro8] **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 Institut of Radioelectronics and Multimedia Technology, WUT), P. Bogorodzki, E. Piątkowska-Janko, K. Lipiński;
Jul. 16, 2019 - Jul. 15, 2024
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.

[Pro9] **Standardize the measurement of dielectric properties of materials for 5G** (Standaryzacja pomiaru własności dielektrycznych materiałów na potrzeby technologii 5G)
Bartłomiej Salski;
Jul. 12, 2022 - Dec. 12, 2024
PolishMetrology

The main goal of this project is to elaborate an error budget of the complex permittivity measurement with a Fabry-Perot open resonator in the 20-110 GHz range. In addition , a new type of a dielectric resonator applicable to the characterization of ceramic pills above 20 GHz will be developed.

4.2.3. Grants for young researchers

[Pro10] **Accurate methods of materials spectroscopy in mm-wave and sub-THz frequencies** (Dokładne metody spektroskopii materiałów w paśmie milimetrowym I subterahercowym).
Jerzy Cuper, P. Kopyt;
Jul. 30, 2019 – Feb. 29, 2024
Diamond Grant
Funded by the Ministry of Science and Higher Education

The purpose of this project was to develop new, accurate and reliable methods for material characterization in mm-wave and sub-THz frequencies, where most of the high-tech industry was carrying out researches for 5G and IoT. Work would be focused on resonant methods, especially on Fabry-Perot open resonator structure. Firstly, a dedicated setup for both low-loss materials and conductive samples would 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 would be designed, fabricated partly at the Warsaw University of Technology, and tested within this project.

[Pro11] **Novel autonomous measurement system for characterization of dielectric materials at microwave and milimeter-wave frequencies** (Nowy autonomiczny system pomiarowy do charakteryzacji materiałów dielektrycznych w zakresie mikrofal i fal milimetrowych).
Tomasz Karpisz;
Jan. 01, 2022 – Dec. 31, 2024
LIDER XII
Funded by the National Centre for Research and Development

The proposed project is devoted to research on the creation of new systems for measuring the electromagnetic properties of materials in the field of mycophagus and millimeter waves. There are solutions on the market that allow you to determine these values, but each of the methods has its limitations discussed in more detail in the project description.

4.3 Projects granted by the University

4.3.1 Priority Research Area Grants

[Pro12] **Measurement data compression algorithms and their hardware implementations for the needs of the COMPASS and DarkSide experiments** (Algorytmy kompresji danych pomiarowych i ich sprzętowe implementacje dla potrzeb eksperymentów COMPASS i DarkSide).
Grzegorz Pastuszak, Andrzej Buchowicz, Grzegorz Galiński
Jan. 01, 2024 – Dec. 31, 2024
Internal grant - High energy physics and experimental technique.

The project supported researchers in the field of design research and engineering work on compression algorithms in two collaborations of physics experiments AMBER and DarkSide. As part of the work in both collaborations, statistical analysis of new measurement data was performed and compression algorithms were modified to adapt them to new statistics. Hardware architectures were developed and then implemented in FPGA systems. As part of the work in these tasks, optimization was performed in terms of minimizing the resources used and meeting the imposed clock frequencies of the systems. For the DarkSide experiment, a software decoder implementation in C++ was also made to decode a multiplexed stream from 64 channels in real time. The designed modules were verified in simulations.

[Pro13] **Analysis of the impact of ambisonic speaker configuration on sound scene perception in VR applications** (Analiza wpływu konfiguracji głośników ambisonicznych na percepcję sceny dźwiękowej w aplikacjach VR).
Agnieszka. P. Pietrzak, Karolina Pondel-Sycz, Andrzej Budny, Jan Brzeziński, Łukasz Pokorzyński, Mateusz Zych, Maciej Marcinkiewicz
Jun. 18, 2024 – Jun. 30, 2025

The aim of this research project is to analyze the impact of ambisonic speaker system configuration on user perception and immersion in a sound scene. Spatial audio is an essential element in creating immersive VR experiences. The optimal placement of speakers around the listener can significantly enhance the quality and realism of spatial sound, directly influencing user perception and emotional response. Different numbers and arrangements of speakers in space may affect the accuracy of virtual sound source localization as well as the overall evaluation of spatial sound quality. The project aims to identify optimal speaker configurations that can enhance realism and engagement in virtual audio environments.

[Pro14] **Specialized support from the Electronics and Detectors laboratory „Electronics and Detectors for High Energy Physics – ELHEP”** (Wsparcie specjalistycznej pracowni Elektroniczno-Detektorowej "Electronics and Detectors for High Energy Physics – ELHEP”).
Marcin Ziembicki
Jun. 01, 2024 – May. 31, 2025

The aim of the project " Electronics and Detectors for High Energy Physics - ELHEP " is to provide manpower, material and logistical support for currently ongoing and planned research activities related to the IDUB-POB-FWEiE project. The activities implemented within the scope of this project include: supporting the design work in related to equipment, modules and complete systems, including detector modules and

specialized electronics for physics experiments; supporting the maintenance of experimental equipment; preparation of "proof of concept" experiments; performing comprehensive feasibility studies (concept, visualizations); support for bachelor, masters and doctoral students participating in high-energy projects realized by the institute.

[Pro15] **Discovery of endometriosis biomarkers from proteomic and metabolomic LC-MS/MS data** (Identyfikacja markerów diagnostycznych endometriozy na podstawie danych LC-MS/MS z badań protomicznych i metabolomicznych)
Tymon Rubel
Sep. 02, 2024 – Dec. 31, 2025

The project aims to develop and implement algorithms for selecting protein and metabolite diagnostic markers of endometriosis from liquid chromatography-mass spectrometry (LC-MS/MS) data.
Endometriosis is a common gynecological disease that significantly affects patients' functioning and quality of life. Unfortunately, its etiology remains unclear, and its accurate diagnosis still faces serious difficulties.
A better understanding of endometriosis formation and development is possible through molecular biology research, particularly in proteomics and metabolomics. Both these fields of science extensively use the LC-MS/MS technique, which allows the simultaneous detection of large sets of proteins and metabolites in biological samples. However, combining the knowledge obtained from proteomic and metabolomic studies remains a non-entirely resolved issue. Therefore, this project will mainly focus on integrating results obtained at protein and metabolite levels to increase the biomarkers' diagnostic potential and to achieve a reliable, common biological interpretation.
The project will utilize data from research conducted by Prof. Piotr Laudański from the Medical University of Warsaw, who will also be responsible for the medical verification of the analysis results. A close cooperation with the Mass Spectrometry Laboratory of the Institute of Biochemistry and Biophysics PAS is also planned, as its team performed LC-MS/MS measurements for the project and is the primary user of the created software.

[Pro16] **Organization of the National Student Conference on Acoustics (OSKA) 2025** (Organizacja Ogólnopolskiej Studenckiej Konferencji Akustyków OSKA 2025)
Agnieszka P. Pietrzak, Karolina Pondel-Sycz, Andrzej Budny, Łukasz Pokorzyński, Mateusz Zych, Maciej Marcinkiewicz, Katarzyna Stec, Tomasz Murawski, Julia Szymla, Wojciech Halber, Daria Kałowska
Dec. 04, 2024 – Nov. 14, 2025

The aim of the project is to organize the National Student Conference on Acoustics (OSKA) 2025, an annual scientific event bringing together students and young researchers in the field of acoustics. The conference, held since 2013 at various Polish universities, serves as a platform for presenting achievements, exchanging experiences, and integrating the academic community. The OSKA 2025 program will cover a wide range of topics, including architectural, musical, and biomedical acoustics, psychoacoustics, signal processing, electroacoustics, and sound engineering. The need for this project arises from the selection of the Electroacoustics Scientific Circle as the organizer of this year's edition. The conference will enhance the university's recognition, strengthen the position of student research groups, and contribute to the promotion of scientific research and student initiatives on a national level.

[Pro17] **Reconstruction of three-dimensional images in electrical capacitance tomography using deep neural networks** (Rekonstrukcja obrazów trójwymiarowych w elektrycznej tomografii pojemnościowej z użyciem głębokich sieci neuronowych).
Damian Wanta,
Apr. 03, 2023 – Apr. 31, 2025
YOUNG, WUT

Electrical capacitance tomography is an imaging technique that enables obtaining a spatial distribution of electric permittivity based on the mutual capacitances measured using a set of electrodes surrounding investigated area. ECT allows for obtaining a very large number of images per second and so can be used to image dynamic processes, like multiphase flow, widely used in the pharmaceutical, petrochemical, and food industries. Due to the limited number of electrodes used, the spatial resolution of the images obtained is low. Increasing the number of electrodes would mean reducing their surface area, and thus limiting measured capacitances to values of the order of hundreds of attofarads. The measurement of such low values would be a significant challenge.
In three-dimensional tomography, data acquisition is performed using electrodes located in several rings. Based on one set of excitations, it is possible to reconstruct the three-dimensional distribution of permittivity in the entire volume of interest. Obtaining good quality images based on three-dimensional data acquisition is possible with the use of non-linear iterative reconstruction algorithms. These algorithms require repeated solving of a forward problem consisting in simulation of electric field distribution. Achieving an accurate simulation of a three-dimensional electric field requires the use of a very large number of discretization mesh elements, which results in a large computational load. As a result, the time needed to reconstruct a single 3D image with the use of modern personal computers can range from a few to several dozen minutes.
Image reconstruction using deep neural networks is much faster than non-linear inverse problem-solving methods, allowing for many images per second. The aim of this project is to develop a neural network architecture that will allow for obtaining better quality images than in classical reconstruction methods, such as the Lovenberg-Marquard algorithm. It is planned to generate large and diverse training data using both numerical simulation and real measurements. We want to check whether a neural network trained with simulated data will cope well enough with real measurements. The obtained images will be compared with images obtained using non-linear algorithms. For this purpose, a new test object will be proposed for the assessment of spatial resolution, enabling the determination of the modulation transfer function. We want to investigate how the neural network deals with stability when imaging fast-changing processes and whether it is possible to obtain images of better quality in real time measurement.

4.3.2. Internal grants

[Pro18] **New method for high time-resolution measurements of fast microwave switches transient states using a vector network analyzer** (Nowa metoda pomiaru stanów przejściowych szybkich przełączników mikrofalowych z wysoką rozdzielczością czasową za pomocą wektorowego analizatora obwodów).
Paweł Bajurko, J. Sobolewski;
Apr. 23, 2024 – Dec, 31, 2025
Project granted by the Scientific Council for Automatics, Electronics, Electrical Engineering and Space Technologies, WUT.

The aim of this study is to develop a method that enables the application of a vector network analyzer to measure the fast transient states of microwave switches.

[Pro19] **Calorimetric method for measuring the heating power of superparamagnetic nanoparticles in a system of partial thermal insulation** (Kalorymetryczna metoda pomiaru mocy grzania nanocząstek superparamagnetycznych w układzie niepełnej izolacji termicznej).
Grzegorz Domański;
Jun. 03, 2024 – Nov. 30, 2025
Project granted by the Scientific Council of Biomedical Engineering, WUT.

The aim of the project is to develop a calorimetric method for determining the power of superparametic nanoparticles in conditions of incomplete thermal insulation. One of the most reliable methods for measuring the heating efficiency of nanoparticles is calorimetric measurement of the sample temperature during stimulation with an alternating magnetic field. Accurate measurement of heating power requires full thermal insulation, otherwise part of the heat power transferred to the environment will result in a significant underestimation of the heating power of nanoparticles. The aim of the project is to create the best possible thermal insulation system using the circulation of the cooled liquid and to develop a thermoelectric replacement model from RC components, taking into account both the incomplete thermal insulation of the system, as well as other factors affecting the accuracy of heating power measurement, such as the heat generated by the transmitting coil or ambient temperature fluctuations. Initial calibration measurements made with a source of known heating power will allow the identification of substitute parameters of the model, which in the next step will be used to precisely determine the heating power, taking into account the power losses and the influence of other external factors.

[Pro20] **Detection of persons' falls by means of a monitoring system based on impulse-radar sensors** (Wykrywanie upadków osób w systemie monitoringu opartym na impulsowych czujnikach radarowych).
Roman Z. Morawski;
Jun. 1, 2023 – Nov. 30, 2024
Project awarded by the Scientific Council of Biomedical Engineering, WUT.

The project is aimed at developing methods for processing measurement data acquired by means of impulse-radar sensors – the methods enabling the analysis of the movement of monitored persons, as well as the prediction and detection of events that threaten their health or life, such as falls. The developed methods are intended for use in non-invasive monitoring of elderly persons. The results of the project will be included into the Ph.D. thesis prepared by Szymon Kruszewski under supervision of Roman Z. Morawski.

[Pro21] **Method for determining the electrode-skin contact capacitance in medical electrical capacitive tomography measurements** (Metoda wyznaczania pojemności kontaktu elektrody ze skórą w pomiarach medycznej elektrycznej tomografii pojemnościowej)**.**
Damian Wanta;
Jun. 1, 2023 – Nov. 30, 2024
Project awarded by the Scientific Council of Biomedical Engineering, WUT.

The project aims to develop a method for determining the electrode-skin contact capacitance during Electrical Capacitance Tomography (ECT) measurements. As part of the project, measurements will be performed using the pulse excitation method, in which the distribution of permittivity and conductivity in the examined space can be determined based on the shape of the measured signal. Changes in the electrode's insulation capacitance, resulting from improper adhesion to the skin, strongly influence the nature of the measured pulse, making it impossible to analyze its shape correctly. Precise determination of the contact capacitance value will enable the determination of the components of the tested impedance and thus will allow the practical use of dry electrodes in tomographic measurements.

[Pro22] **Methods for determining the ratio of bound superparamagnetic nanoparticles (MNPs) using Magnetic Nanoparticle Spectroscopy (MPS)** (Metody wyznaczania za pomocą Spektroskopii Magnetycznej Nanocząstek (MPS) stosunku związanych nanocząstek superparamagnetycznych (MNP)).
Przemysław Wróblewski;
Jun. 1, 2023 – Nov. 30, 2024
Project awarded by the Scientific Council of Biomedical Engineering, WUT.

The aim of this project is to use multi-frequency magnetic particle spectroscopy (MPS) to develop a method for estimating the ratio of immobilized and free magnetic nanoparticles (MNPs) in the tested samples based on the difference in the complex magnetic permeability at selected frequencies when only one mode of nanoparticle relaxation (Brown or Neal) dominates. It can be used to quantitatively track MNP-labeled cells in MPI magnetic nanoparticle imaging.

4.4. Other projects

[Pro23] **Designing RF circuits for LTE 450 MHz base station for critical applications** (Projektowanie obwodów RF do stacji bazowej LTE 450 MHz do zastosowań krytycznych).
Wojciech Wojtasiak, Daniel Gryglewski
Apr. 06, 2023 – Apr. 30, 2025
Funded by Telco Feng 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 is 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.

[Pro24] **Experimental investigation of planar antenna arrays in X-band** (Badania planarnych szyków antenowych w paśmie X).
Grzegorz Bogdan, Jakub Sobolewski
Feb. 8, 2023 – Dec. 31, 9999
Funded by Eycore Sp. z o.o.

Electrical parameters of planar antenna arrays were measured in the frequency range of 9-10.5 GHz with various methods and configurations. Fundamental characteristics as the radiation pattern and the impedance matching were determined separately for individual components (i.e. antennas and feeding networks) and assembled arrays. This involved measurements of scattering matrices of 9-port networks and measurements of the absolute gain in two orthogonal planes with an angular step as low as 0.6 degree.

[Pro25] **Examination of E-band antenna scattering parameters** (Badanie parametrów rozproszenia anten na pasmo E)
Paweł Bajurko
Feb. 15 – 29, 2024
Funded by Thorium Space S.A.

A set of E-band antennas was examined in this work to determine their S-parameters.

[Pro26] **Developing of the preliminary concept of the RF sensor to detect the regolith inside the excavator shovel** (Opracowanie wstępnej koncepcji czujnika RF do detekcji pobrania regolitu przez łopatkę robota)
Krzysztof Kurek
Mar. 14 – Apr. 28, 2024
Funded by CBK PAN.

The aim of this work was to develop a preliminary concept of a sensor to detect the amount of a moon regolith inside an excavator shovel using radiofrequency waves. The use of the microstrip line placed inside the shovel and immersed in the regolith was proposed as the RF sensing element. The measurement of the phase of the reflected electromagnetic wave propagated in the line was used to determine the amount of the regolith scooped into the shovel.

[Pro27] **Measurements of a transmitter and preparation of its directional patterns** (Przeprowadzenie badania nadajnika oraz opracowanie wykresu charakterystyk kierunkowych)
Grzegorz Bogdan
Jul. 11 – 12, 2024
Funded by Advanced Protection Systems S.A.

A wireless microwave transmitter with a phased array for the X-band was measured inside an anechoic chamber with an in-house developed setup based on a signal generator and spectrum analyzer. Measured data were used to prepare a series of graphs presenting directional patterns of the transmitter.

[Pro28] **Measurements of TX PA00253 antenna in the anechoic chamber and preparation of directional patterns in terms of the equivalent isotropically radiated power (EIRP)** (Przeprowadzenie pomiarów anteny TX PA00253 w komorze antenowej i opracowanie charakterystyki kierunkowej ekwiwalentnej mocy promieniowanej izotropowo (EIRP) modułu nadawczego z anteną TX PA00253)
Grzegorz Bogdan
Jul. 12 – 15, 2024
Funded by Advanced Protection Systems S.A.

A phased array antenna for the X-band was measured inside an anechoic chamber with an in-house developed setup based on a signal generator and spectrum analyzer. Measured data were used to prepare a series of graphs showing directional patterns in terms of the equivalent isotropically radiated power (EIRP).

[Pro29] **Measurement validation of the regolith quantity detection method using the RF sensor** (Walidacja pomiarowa metody detekcji ilości regolitu z wykorzystaniem czujnika RF)
Krzysztof Kurek
Aug. 5 – Oct. 4, 2024
Funded by CBK PAN.

The aim of this work was to validate by measurements the developed concept of a sensor to detect the amount of the moon regolith inside an excavator shovel using radiofrequency waves. The microstrip line placed on the wall of the shovel was used as the RF sensing element, and measurements of the reflection coefficient S11 phase variation, using a network vector analyzer, were used to estimate the quantity of the regolith inside the shovel. Measurements were done during scooping campaign performed in the CBK PAN, and the results were used to estimate the accuracy of determining the amount of the regolith inside the shovel using the proposed RF sensor.

[Pro30] **Examination of the 4-channel multiband quadrature receiver** (Badanie 4-kanałowego wielopasmowego odbiornika kwadraturowego)
Paweł Bajurko
Oct. 29 – Mar. 31, 2025
Funded by SIRC Sp. z o.o.

The objective of this study is to examine the operational characteristics of the 4-channel multiband quadrature receiver.

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

Intelligent Transport

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

CentriX

The new established science and technology platform CentriX is founded by European Regional Operation Fund 2014 – 2020 for Mazowian Voivodeship. This project is carried out at National Center for Nuclear Research, Institute of Radioelectronics and Multimedia Technology with co-operation of Imagine RT Ltd., and Eastern Wall Technologies Ltd. The main goal of this project is to establish the innovation and scientific center and realize researches in the field of industry radiation techniques. 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 Radiolectronics and Multimedia Techno-logy 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**
2017-2021

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 sub systems in terms of PIC models and monolithic integration.
WG3: The goal is to identify the IMWP opportunities in terms of generation, SWaP, bandwidth, and integration to unlock the future 5G communications.

Polish Network of Neutrino Physics (Polska Sieć Neutrinowa)

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

Polish Network of Particle Astrophysics (Polska Sieć Astrofizyki Cząstek)

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

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

In 2012 the Faculty of Electronics and Information Technology, Institute of Radioelectronics and Multimedia Technology (the Division of Nuclear and Medical Electronics) joined the project realized in the frame for the research collaboration of several Polish and foreign institutes. The main aim of this Action is to stimulate and accelerate collaborations and joint research efforts between European groups into hyperpolarization physics and methodology with the goal to develop robust strategies for sensitivity enhancement in NMR and

MRI. Coordinated short-term scientific missions (STSMs) will make it possible to fully exploit the potential of unique scientific instrumentation which already exists in few European groups. The scientific programme is organised into 5 different working groups that focus on key issues related to the topic of the Action. The scientific programme is supported by a wide range of research groups thus generating a high added value for the European research landscape.

4.5.3. Student research groups

Space Engineering Student Research Group

Krzysztof Kurek – tutor.

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

Biomedical and Nuclear Engineering Student Research Group

Grzegorz Domański – tutor.

Biomedical and Nuclear Engineering Student Scientific Group (in Polish: Studenckie Koło Inżynierii Biomedycznej i Jądrowej “Biomedyczni”) was formed in Dec. 2005 by a group of students from Biomedical Engineering. The group worked on software enabling determination of longitudinal relaxation time based of a series of images with different inversion time (TI). The "Arduino for biomedical applications" project has been initiated to develop student interests in the design of new electronic systems, software, and use them in biomedicine. The main objective of the project group is to get acquainted with the electronic platform Arduino programming environment for creating low-cost, flexible and easy-to-use devices. The acquired knowledge and skills will be use at a later stage of the project to develop and implement a multi-functional system for biomedical use, based on the Arduino platform and additional electronic components.

Innovative Information Technologies Student Scientific Group

Przemysław Miazga – tutor.

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

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 ucational 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).

Electroacoustics Scientific Student Research Group

Agnieszka Paula Pietrzak – tutor.

Electroacoustics Scientific Club of Warsaw University of Technology, is affiliated with the Electroacoustics Department of the Institute of Radio electronics and Multimedia Techniques at the Faculty of Electronics and Information Technology. The area of activity of the Electroacoustics Scientific Club includes: design and construction of electroacoustic devices, design of electroacoustic systems, studio recording sessions and mastering, surround sound, development of software for processing and measuring sound signals, application of Artificial Intelligence (AI) to sound signals, speech acoustics, electroacoustic measurement systems.

Members of the Electroacoustics Scientific Club conduct projects, give speeches at scientific conferences, and support the organization of conferences and fairs (e.g. Audio Video Show Warsaw, polish conferences on acoustics: ISSET, OSA and OSKA). Scientific Club also cooperates with other scientific clubs and student organizations, organizing joint initiatives (e.g. realization of radio studio concerts in the recording studio of the Electroacoustics Department in cooperation with the WUT radio station - Radio Aktywne). The scientific supervisor of the club is Agnieszka Paula Pietrzak, PhD. Board: chairman - Karolina Pondel-Sycz, M.Sc.; vice-chairman - Andrzej Budny, Eng.; treasurer/secretary - Kamil Drzewiecki

4.6. Instrumentation Investments

4.6.1. Centre for Biomedical Technology and Medical Physics

Nuclear and Medical Electronics Division (**Krzysztof Zaremba** – head)
2008 - 2021
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

2016 – 2021

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

4.6.3. Sub-terahertz Technology and Antenna Laboratory

Yevhen Yashchyshyn, P. Bajurko;
2010 – 2021
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, ima- ging and radar system.

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 Świerk, 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 M.Sc. Degrees

[MSc1] Anna Berent: "*Metody wspomagania diagnozy i terapii skoliozy na podstawie radiogramów i danych medycznych*" (Methods to support diagnosis and therapy of scoliosis using spinal radiograms and clinical data), Prof. **A. Przelaskowski** (supervisor).

[MSc2] Ji Changyuan: "A Wideband one Bit Reconfigurable Reflectarray Antenna at K-Ban", Prof. **Y. Yashchyshyn** (supervisor), studies in English.

[MSc3] Zhu Chongwen: *"Design of three-element circular polarization antenna array based on sequentially rotated feed technique",* Assist. Prof. **P. Bajurko** (supervisor), studies in English.

[MSc4] Ashenafi Sime Debele: *"Image Coloring Using Invertible Neural network (INN)"*, Prof. **W. Skarbek** (supervisor), studies in English, M.Sc. degree with honours.

[MSc5] Aleksandra Julia Dudek: *"Badania rozproszenia pola akustycznego w studio dźwiękowym w Gmachu Elektroniki Politechniki Warszawskiej po przebudowie"* (Sound field diffuseness of the sound studio in the Electronics Building of the Warsaw University of Technology after modernization), Prof. **J. Żera** (supervisor), M.Sc. degree with honours.

[MSc6] Paulina Goluch: *"Badania właściwości akustycznych studia dźwiękowego w Gmachu Elektroniki Politechniki Warszawskiej po przebudowie"* (Acoustic properties of the sound studio in the Electronics Building of the Warsaw University of Technology after modernization), Prof. **J. Żera** (supervisor).

[MSc7] Rafał Gorecki: „*Metody automatycznego rozpoznawania nagrań utworów zespołu The Beatles na podstawie ich intonowanych fragmentów za pomocą sieci neuronowych i technik analizy czasowo-częstotliwościowej*" (Methods of automatic recognition of The Beatles' songs recordings based on their intoned parts using neural networks and time-frequency analysis), Assist. Prof. **J. Wagner** (supervisor).

[MSc8] Minji Hu: *"Design and Simulation of RFID Tag Antenna and Application in Healthcare"*, Prof. **Y. Yashchyshyn** (supervisor), studies in English.

[MSc9] Karolina Janiszewska: *„Sonda do pomiaru relaksacji i dyfuzji próbek metodą MRI w polu o indukcji 0.23T"* (MRI probe for relaxation and diffusion measurement in 0.23 T field), Assoc. Prof. **P. Bogorodzki** (supervisor), M.Sc. degree with honours.

[MSc10] Akshat Kamboj : *„Analysis of Wi-Fi 6"*, Assoc. Prof. **P. Bilski** (supervisor), studies in English.

[MSc11] Ada Kawala: *„Program do analizy przebiegów elektrokardiograficznych w celu wykrywania schorzeń"* (Program for analyzing electrocardiographic waveforms to detect diseases), Assist. Prof. **G. Domański** (supervisor).

[MSc12] Zofia Knapińska: „*Badanie możliwości zastosowania metod uczenia maszynowego w diagnostyce demencji*" (Exploring the Potential Applications of Machine Learning Techniques for the Diagnosis of Dementia), Prof. **J. Mulawka** (supervisor)

[MSc13] Aleksandra Krakowiak: *„Algorytm klasteryzacji widm mas pochodzących z badań proteomicznych*" (Algorithm for clustering mass spectra derived from proteomic research), Assist. Prof. **T. Rubel** (supervisor).

[MSc14] Kacper Kubicki: *" Porównanie skuteczności algorytmów uczenia maszynowego na podstawie danych pochodzących z badań transkryptomicznych"* (Comparison of machine learning algorithms effectiveness based on transcriptomic data), Assist. Prof. **R. Kurjata** (supervisor).

[MSc15] Martyna Muszyńska: „Automatyczna segmentacja nerek na obrazach medycyny nuklearnej za pomocą metody analitycznej i opartej na uczeniu maszynowym" (Automatic kidney segmentation in nuclear medicine images using analytical and machine-based methods), Assoc. Prof. **W. Smolik** (supervisor).

[MSc16] Michał Nurek: *„System do monitoringu parametrów układu akwizycji dla modułów multi-PMT w detektorze pośrednim eksperymentu Hyper-Kamiokande"* (Multi-PMT signal acquisition parameters monitoring system for intermediate detector of Hyper-Kamiokande experiment), Assist. Prof. **M. Ziembicki** (supervisor).

[MSc17] Jakub Pęksyk: *„Badanie możliwości wykorzystania modułów BLE v5.1 do celów lokalizacji wewnątrz pomieszczeń" (*Exploring the capabilities of BLE v5.1 modules for indoor localization purposes), Assist. Prof. **V. Djaja-Jośko** (supervisor).

[MSc18] Bartosz Piotrowski: *" Pomiar afterpulsów w zależności od podziału napięć na dynodach fotopowielacza w projekcie Hyper-Kamiokande"* (Measurement of Afterpulses Depending on the Voltage Division on the Photomultiplier Tube Dynodes in the Hyper-Kamiokande Project), Assist. Prof. **A. Rychter** (supervisor).

[MSc19] Maciej Paweł Radzimirski: *„Sterowanie ramieniem robotycznym za pomocą sygnału EMG"* (Robotic arm control using EMG signal), Assist. Prof. **A. Rychter** (supervisor).

[MSc20] Pranav Narayan Sajeev: *"Analysis of the Propagation Characteristics in 6G Transmission"*, Assoc. Prof. **P. Bilski** (supervisor), studies in English.

[MSc21] Ada Sawilska: *"Wykrywanie ognisk padaczki na podstawie danych EEG-fMRI"*

(Epileptic foci localization based on EEG-fMRI data), Assoc. Prof. **P. Bogorodzki** (supervisor).

[MSc22] Mykyta Shaltyko: *"Analysis of MRI perfusion data from patients with multiple sclerosis"*, Assoc. Prof. **P. Bogorodzki** (supervisor), studies in English.

[MSc23] Hanna Katarzyna Smach: *"Oprogramowanie analizujące dynamikę pisania na klawiaturze do zastosowania w diagnostyce schorzeń neurologicznych"* (Software for analysis of keystroke dynamics in application to neurological diseases diagnosis), Assist. Prof. **R. Kurjata** (supervisor), M.Sc. degree with honours.

[MSc24] Anna Stachurka: *"Automatyczne rozpoznawanie instrumentów muzycznych przy użyciu uczenia maszynowego"* (Automatic musical instrument recognition using machine learning), Assist. Prof. **J. Wagner** (supervisor).

[MSc25] Witold Synowiec: *"Segmentacja lezji stwardnienia rozsianego w wykorzystaniem splotowych sieci neuronowych"* (Multiple Sclerosis lesion segmentation using convolutional neural networks), Assist. Prof. **R. Kurjata** (supervisor).

[MSc26] Krzysztof Wolski: "*Aplikacja do modyfikacji kolorów samochodów w galeriach zdjęć 360 z wykorzystaniem sieci neuronowych*" (Application for modifying the cars' paint color in the 360 photo galleries using neural networks), Assoc. Prof. **K. Snopek** (supervisor).

[MSc27] Paulina Wójcik: *"Cyfrowy Asystent Terapii (CAT) z funkcją dozowania leków - koncepcja narzędzia wspomagającego pacjentów i ich opiekunów w przewlekłej terapii farmakologicznej"* (Digital Therapy Assistant with medication dosing functionality - concept of a tool to support patients and their caregivers in chronic pharmacological therapy), Prof. **A. Przelaskowski** (supervisor).

[MSc28] Maria Zięcik: "*Zastosowanie metod przetwarzania obrazu i uczenia maszynowego do analizy mammogramów*" (Application of image processing and machine learning methods for mammogram analysis), Assist. Prof. **G. Domański** (supervisor).

[MSc29] Wiktoria Zych: "Aplikacja umożliwiająca wyświetlanie oraz automatyczną trójwymiarową segmentację zmian nowotworowych w obrazach magnetycznego rezonansu jądrowego" (Application for displaying and automatic three-dimensional segmentation of intracranial neoplasms in nuclear magnetic resonance images), Assist. Prof. **A. Rychter** (supervisor), M.Sc. degree with honours.

5.2 B.Sc. Degrees

[BSc1] Maciej Antosz: „*Aplikacja webowa zarządzająca testami mierników sieciowych*" (Web application managing tests of network gauges), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc2] Mikołaj Bańkowski: „*System monitorowania wybranych parametrów zdrowotnych pacjentów"* (Monitoring System for Selected Health Parameters of Patients), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc3] Paweł Baran: „*Rozproszony system rejestracji sekwencji wizyjnych"* (Distributed system for recording video sequences), Assist. Prof. **G. Galiński** (supervisor).

[BSc4] Anastasiya Beliashchuk: „Echnologia blockchain w zastosowaniu do przechowywania elektronicznej dokumentacji medycznej" (Blockchain technology in storage of electronic medical records), Assist. Prof. **R. Kurjata** (supervisor).

[BSc5] Adrian Bereda: „*Miernik bioimpedancji z łączem bezprzewodowym*" (Bioimpedance meter with wireless connection), Assist. Prof. **G. Domański** (supervisor).

[BSc6] Karol Bogumił: *„Zastosowanie standardu HL7 FHIR w szpitalnym systemie informatycznym"* (HL7 FHIR standard appliance in hospital information system), Assist. Prof. **A. Rychter** (supervisor).

[BSc7] Ewelina Borkowska: *"Kinematyczna analiza chodu człowieka za pomocą czujnika głębi"* (Kinematic Analysis of Human Gait Using a Depth Sensor), Assist. Prof. **J. Wagner** (supervisor).

[BSc8] Dominik Brach: *„Aplikacja webowa kliniki medycznej"* (Medical clinic web application), Assist. Prof. **A. Rychter** (supervisor).

[BSc9] Jan Bronowski: *"Modularna Aplikacja Mobilna do Strojenia Instrumentów Muzycznych"* (Modular Mobile Application for Tuning Musical Instruments), Assoc. Prof. **P. Bilski** (supervisor).

[BSc10] Kacper Brzuchala: *" Wzmacniacz dystrybucyjny do sygnałów GNSS"* (Distribution amplifier for GNSS signals), Assist. Prof. **W. Kazubski** (supervisor).

[BSc11] Andrzej Budny: "Modelowanie funkcji pHRTF na podstawie skanu 3D głowy i torsu" (Modeling of pHRTF functions based on head and torso 3D scans), Assist. Prof. **A. Pietrzak** (supervisor).

[BSc12] Jakub Cebeliński: *"Uniwersalne stanowisko pomiarowe charakterystyk kierunkowych głośników i mikrofonów"* (Universal measurement station for directional characteristics of speakers and microphones), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc13] Alex Chmielnicki: *"System wizyjny wykrywający wady wzroku - zeza"* (Strabismus detection system), Assoc. Prof. **B. Siemiątkowska** (supervisor).

[BSc14] Olga Magdalena Chrościcka: „*Bezprzewodowy układ inercyjny do wyznaczania mocy generowanej podczas ćwiczeń siłowych*" (Wireless inertial system for

determining the power generated during strength training), Assist. Prof. **S. Cygan** (supervisor).

[BSc15] Alicja Dąbrowska: *"Projekt ortozo-protezy umożliwiającej chodzenie bez obciążania stopy i stawu skokowego"* (Design of orthoprosthesis enabling walking without loading the foot and ankle joint), Assist. Prof. **S. Cygan** (supervisor), B.Sc. degree with honours.

[BSc16] Wang Dian: *'"Homogeneity statistical analysis using LMRD diagrams"*, Assoc. Prof. **P. Domański** (supervisor), studies in English.

[BSc17] Karol Duszczyk: "Opracowanie układu do badania zmian parametrów chodu" (Development of a device for gait investigation), Assist. Prof. **J. Kołakowski** (supervisor), B.Sc. degree with honours.

[BSc18] Paweł Dyrda: "*Układ generujący sygnały sterujące dla szyku antenowego z modulacją czasową"* (Circuit generating control signals for a time-modulated antenna array), Assist. Prof. **K. Godziszewski** (supervisor).

[BSc19] Aleksandra Fabrycy: *"Wybrane metody automatycznej detekcji zespołów QRS w elektrokardiogramach"* (Selected methods of automatic QRS detection in electrocardiograms), Assoc. Prof. **K. Snopek** (supervisor).

[BSc20] Cyprian Galicki: „Technologia blockchain w zastosowaniu do przechowywania elektronicznej dokumentacji medycznej" (Blockchain technology in application to the storage of electronic medical records), Assist. Prof. **A. Rychter** (supervisor).

[BSc21] Aleksandra Gryzik: *"Sieciowa aplikacja do wizualizacji trójwymiarowych struktur białek"* (Web-based application for the visualisation of three-dimensional protein structures), Assist. Prof. **T. Rubel** (supervisor).

[BSc22] Tomasz Grzelakowski: *"Oprogramowanie internetowe do analizy i wizualizacji przebiegów elektrokardiograficznych"* (Internet software for the analysis and visualization of electrocardiographic waveforms), Assist Prof. **R. Kurjata** (supervisor).

[BSc23] Jinpu Guo: *"Particle Swarm Optimization for shortest path searching in the telecommunication network"*, Assoc. Prof **P. Bilski** (supervisor), studies in English.

[BSc24] Agnieszka Gutowska: "*Algorytmy ekstrakcji sylwetki osoby z surowych danych pomiarowych pochodzących z czujników głębi w systemie monitoringu osób starszych*" (Algorithms for silhouette extraction from raw data acquired by means of depth sensors in system for monitoring elderly persons), Assist. Prof. **P. Mazurek** (supervisor), B.Sc. degree with honours.

[BSc25] Chen Hanqi: *"Development of Remote-Control System for Testing Transducers"*, Assist. Prof. **K. Kuczyński** (supervisor), studies in English.

[BSc26] Wojciech Hrycenko: *"Opracowanie modułu bramki (sterownika) systemu do monitorowania aktywności osób"* (Development of the gateway (controller) of the person activity monitoring system), Assist. Prof. **V. Djaja-Jośko** (supervisor), B.Sc. degree with honours.

[BSc27] Daniel Jaroszewski: „*Wirtualny system akwizycji danych w środowisku LabVIEW do pomiarów odbiorników energii elektrycznej"* (Virtual data acquisition system in the LabVIEW environment for measuring electric power consumers) Assist. Prof. **R. Łukaszewski** (supervisor).

[BSc28] Jakub Jędrys: „*Opracowanie noszonego czujnika do badań środowiskowych*" (Development of a wearable device for environmental sensing), Assist. Prof. **J. Kołakowski** (supervisor).

[BSc29] Hubert Kaczorowski: *"Komunikator z wyświetlaczem e-paper i powiadamianiem haptycznym"* (Communicator with e-paper display and haptic notification), Assist. Prof. **V. Djaja-Jośko** (supervisor).

[BSc30] Magdalena Kalińska: *„Aplikacja mobilna wspierająca alergików"* (Mobile application supporting allergy sufferers), Assist. Prof. **G. Domański** (supervisor).

[BSc31] Michał Kamiński: *„Analiza cech charakterystycznych języka mówionego z wadami wymowy"* (Analysis of the characteristics of spoken language with a speech impediment), Assoc. Prof. **K. Snopek** (supervisor).

[BSc32] Karina Klekowiecka: *„Przenośne urządzenie do badania stanu układu krążenia w warunkach domowych"* (A portable device for examining the state of the circulatory system at home), Assist. Prof. **G. Domański** (supervisor).

[BSc33] Agnieszka Klępka: *„Aplikacja do automatycznej oceny równowagi ciała na podstawie danych wizyjnych"* (Application for automatic evaluation of body balance based on vision data), Assist. Prof. **P. Mazurek** (supervisor).

[BSc34] Natalia Kowalczyk: *"Ogranicznik na pasmo LTE B43"* (LTE Band 43 limiter), Assoc. Prof. **W. Wojtasiak** (supervisor).

[BSc35] Michał Kowalik: *„Aplikacja webowa do dzielenia się przepisami kulinarnymi"* (Web application for sharing culinary recipes), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc36] Michał Kozłowski: *„Wielokanałowy system do pomiaru sygnałów EKG z wykorzystaniem AFE"* (A multi-channel system for measuring ECG signals using AFE), Assist. Prof. **G. Domański** (supervisor).

[BSc37] Patrycja Krankowska: *"Analiza sygnału przy użyciu różnych odbiorników i anten GNSS"* (Signal analysis using different GNSS receivers and antennas), Prof. **J. Modelski** (supervisor).

[BSc38] Dawid Kurpiel: „*Budowa stanowiska do pomiaru ogniska akceleratora liniowego*" (Construction of an experimental stand for linear accelerator beam measurement), Prof. **S. Wronka** (supervisor).

[BSc39] Marcin Kuśmierek: *„Projekt i realizacja modułu radioodbiornika DAB+"* (Design and implementation of a DAB+ radio receiver module), Assist. Prof. **W. Kazubski** (supervisor).

[BSc40] Michał Lewiński: *"Układ energooszczędnej etykiety ultraszerokopasmowego systemu lokalizacyjnego"* (Energy-saving tag device of ultra-wideband localization system), Assist. Prof. **J. Kołakowski** (supervisor).

[BSc41] Yuxuan Liang: *"The method of detecting the presence of the device operator using two IR sensors, camera and IoT technology"*, Assoc. Prof. **M. Borecki** (supervisor), studies in English.

[BSc42] Zhiyu Liu: *"Vision-based application for human fall detection",* Assist Prof. **A. Buchowicz** (supervisor), studies in English.

[BSc43] Junzhe Liu: *"Heuristic algorithm for the optimal path searching in the telecommunication network",* Assoc. Prof. **P. Bilski** (supervisor), studies in English.

[BSc44] Haoran Liu: *„IoT methods in detecting of rain with the local use of camera and sensor set",* Assoc. Prof. **M. Borecki** (supervisor), studies in English.

[BSc45] Kajetan Łachański: „*Oprogramowanie do detekcji komórek w obrazach mikroskopowych próbek krwi*" (Software for cell detection in microscopic images of blood samples), Assist. Prof. **T. Rubel** (supervisor).

[BSc46] Martyna Mackiewicz: *„Badanie parametrów hemodynamicznych przepływu przez tętniak wewnątrzczaszkowy z wykorzystaniem metod numerycznej mechaniki płynów"* (Intracranial aneurysm hemodynamics - a study using computational fluid dynamics methods), Assist. Prof. **A. Piechna** (supervisor), B.Sc. degree with honours.

[BSc47] Krystian Mandecki: *"Układ do detekcji aktywności ruchowej z wykorzystaniem algorytmów sztucznej inteligencji"* (Artificial Intelligence based activity detection device), Assist. Prof. **M. Kołakowski** (supervisor), B.Sc. degree with honours.

[BSc48] Jakub Mielnicki: *„ Stacja pogodowa bazująca na technice radia programowalnego"* (Weather station based on SDR technique), Assist. Prof. **S. Kozłowski** (supervisor).

[BSc49] Filip Misztal: „*Aplikacja do automatycznej oceny poprawności wykonywania czynności fizycznych na podstawie danych wizyjnych i danych z czujnika głębi*" (An Application for Automatic Assessment of Exercise Correctness Based on Vision Data and Depth Sensor Data), Assist. Prof. **P. Mazurek** (supervisor).

[BSc50] Grzegorz Molak: *„Algorytmy estymacji trójwymiarowej trajektorii ruchu osoby starszej w systemie monitoringu opartym na impulsowych czujnikach radarowych"* (Algorithms for estimation of three-dimensional motion trajectories of an elderly person in monitoring system based on impulse-radar sensors), Assist. Prof. **P. Mazurek** (supervisor), B.Sc. degree with honours.

[BSc51] Stanisław Moska: *„Aplikacja do automatycznej oceny poprawności wykonywania czynności fizycznych na podstawie danych wizyjnych i danych z czujnika głębi*" (An Application for Automatic Assessment of Exercise Correctness Based on Vision Data and Depth Sensor Data), Assist. Prof. **P. Mazurek** (supervisor).

[BSc52] Karolina Nowak: *"Badania rozkładów promieniowania wokół aplikatora głowicy akceleratora śródoperacyjnego"* (Studies of radiation distributions around the applicator of the intraoperative accelerator head), Prof. **S. Wronka** (supervisor).

[BSc53] Dominik Nuszkiewicz: *„System do przechowywania i wymiany elektronicznej dokumentacji medycznej w oparciu o technologię blockchain"* (A system for storing and exchanging electronic medical records based on blockchain technology), Assist. Prof. **A. Rychter** (supervisor).

[BSc54] Małgorzata Olech: *„Aplikacja do symulacji działania protokołów wielodostępu z rywalizacją w sieciach bezprzewodowych"* (Application for simulating contention-based multiple access protocols in wireless networks), Assist. Prof. **K. Godziszewski** (supervisor).

[BSc55] Karolina Olszewska-Majewska: „Użycie sztucznej sieci neuronowej do klasyfikacji schorzeń nowotworowych na podstawie danych o aktywności genów" (The use of an artificial neural network for the classification of cancer diseases based on gene activity data), Assist. Prof. **T. Rubel** (supervisor).

[BSc56] Justyna Pawlak: *„Urządzenie do jednoczesnej rejestracji sygnału elektrokardiograficznego i odpowiedzi galwanicznej skóry"* (Device for simultaneous recording of the electrocardiographic signal and the galvanic response of the skin), Assist. Prof. **G. Domański** (supervisor).

[BSc57] Julia Pietraszek: *„Oprogramowanie do konwersji badań medycyny nuklearnej z formatu NMS do standardu DICOM"* (Software for nuclear medicine data conversion from NMS file format to DICOM standard), Assoc. Prof. **W. Smolik** (supervisor).

[BSc58] Igor Pietruszczak: *"Rekonstrukcja trójwymiarowa skanów z tomografii komputerowej do wykorzystania w technologii druku 3D"* (Three-dimensional reconstruction of computer tomography scans for use in 3D printing technology), Assist. Prof. **G. Domański** (supervisor).

[BSc59] Marcel Piotrowski: *„Analiza czasowo-przestrzenna ruchu deskorolkarzy za pomocą czujnika głębi"* (Spatiotemporal analysis of the movement of skateboarders by means

of a depth sensor), Assist. Prof. **J. Wagner** (supervisor).

[BSc60] Piotr Plichta: *„Opracowanie modułu modemu LTE-M / NB-IoT”* (Development of a modem module for LTE-M and NB-IoT), Assist. Prof. **J. Kołakowski** (supervisor), B.Sc. degree with honours.

[BSc61] Zuzanna Popławska: *“Projekt i realizacja systemu webowego dla laboratorium diagnostycznego”* (Design and implementation of a web system for a diagnostic laboratory), Assist. Prof. **P. Bobiński** (supervisor), B.Sc. degree with honours.

[BSc62] Dawid Potwora: *“Wykorzystanie filtru Kalmana w analizie chodu człowieka za pomocą czujników głębi”* (Utilizing the Kalman filter in the analysis of human gait using depth sensors), Assist. Prof. **J. Wagner** (supervisor).

[BSc63] Dominika Powałka: “*Aplikacja mobilna e-zdrowie*” (E-health application for mobile devices), Assist. Prof. **R. Kurjata** (supervisor).

[BSc64] Wan Qiaoyu : “*Title of the thesis in English: Development of Remote Control of the Audio Analyzer*”, Assist. Prof. **K. Kuczyński** (supervisor), studies in English.

[BSc65] Krzysztof Psuty: “*Analiza spektralna obrazu nieba z wykorzystaniem kamer RGB i IR oraz metod Internetu Rzeczy*” (Spectral analysis of the sky image using RGB and IR cameras and Internet of Things methods), Assoc. Prof. **M. Borecki** (supervisor), studies in English.

[BSc66] Kazimierz Roman: “*System do monitorowania narażenia na wibracje*” (Vibration Exposure Monitoring System), Assist. Prof. **J. Kołakowski** (supervisor).

[BSc67] Anastasiya Ronskaya: *“System kontroli wejścia do pomieszczeń bez nadzoru”* (Unattended entry control system), Assist. Prof **G. Galiński** (supervisor).

[BSc68] Mikołaj Różycki: “*Aplikacja do automatycznej detekcji i rozpoznawania tablic rejestracyjnych*” (Application for automatic detection and recognition of license plates), Assist. Prof **G. Galiński** (supervisor).

[BSc69] Xudong Shu: “Methods of the Internet of Things in application to determine the color of the sky, taking into account the intensity of sunlight”, **Prof. M. Borecki** (supervisor), studies in English.

[BSc70] Zhou Shuhan: “*Development of the Remote Control of Waveform Generator*”, Assist. Prof. **K. Kuczyński** (supervisor), studies in English.

[BSc71] Aleksy Artur Sierpiński: “*Model mimetyczny dłoni do zastosowań w zdalnej chirurgi*” (Mimetic model of hand for telesurgery), Assist. Prof. **G. Domański** (supervisor).

[BSc72] Piotr Sioch: “*System zarządzania inteligentnym domem*”, (Smart Home Management System), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc73] Łukasz Słowik: “*Opracowanie anteny i szyku antenowego na podłożu LCP dla sieci 5G zakresu 26 GHz*” (Design of an antenna and antenna array on an LCP substrate for a 5G network in the 26 GHz frequency range), Prof. **Y. Yashchyshyn** (supervisor).

[BSc74] Kamil Syzdoł: “*Stereofoniczny system automatycznej regulacji wzmocnienia w torze audio*” (Automatic auto gain control system), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc75] Jakub Szczękulski: “*Mobilny kalendarz*” (Mobile Calendar), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc76] Wojciech Szepietowski: *“Stanowisko do bezznacznikowej analizy postury człowieka”*, (A station for marker-free analysis of human posture) Assist. Prof **S. Cygan** (supervisor).

[BSc77] Anna Szymańska: “*Algorytmy rozpoznawania czynności osoby starszej w systemie monitoringu opartym na impulsowych czujnikach radarowych*” (Algorithms for Recognition of Elderly Person's Action in Impulse-radar-based Monitoring), Assist. Prof. **P. Mazurek** (supervisor), B.Sc. degree with honours.

[BSc78] Julia Szymla: “*Porównanie modeli End-to-End do automatycznego rozpoznawania mowy w języku polskim*” (Comparison of End-to-End models for automatic speech recognition in Polish), Assist. Prof. **A. Pietrzak** (supervisor).

[BSc79] Marcin Szymosz: “*Analiza pola akustycznego metodą promieniową w aplikacji webowej*” (Room acoustic analysis with ray tracing method in a web application), Assist. Prof. **M. Lewandowski** (supervisor).

[BSc80] Olaf Teperek: „*Mobilny monitor bilansu kalorycznego*” (Mobile calorie balance monitor), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc81] Aleksandra Tomaszewska: “*Aplikacja umożliwiająca pomiar częstotliwości skurczów serca na podstawie analizy sekwencji obrazów twarzy*” (An application for the heart rate estimation based on facial image sequence), Assoc. Prof. **J. Żmigrodzki** (supervisor).

[BSc82] Anna Twarowska: “*Prototyp pompy infuzyjnej*” (Infusion pump prototype), Assist. Prof. **A. Rychter** (supervisor).

[BSc83] Michał Twarowski: “*Opracowanie modułu sterownika węzła systemu do monitorowania aktywności osób*” (Elaboration of a system node driver module for monitoring people's activity), Assist. Prof. **V. Djaja-Jośko** (supervisor), B.Sc. degree with honours.

[BSc84] Xiaoxuan Wang: „*Speech Emotion Recognition system in Neural Network for edge device*", Assist. Prof. **X. Chang** (supervisor), studies in English.

[BSc85] Yiming Wang: *"Simulation of the signal detection module at the receiver using decision tree classifier",* Assoc. Prof. **P. Bilski** (supervisor), studies in English.

[BSc86] Chen Wang: „*Design of Heuristic algorithm for routing in telecommunication networks*", Assoc. Prof. **P. Bilski** (supervisor), studies in English.

[BSc87] Zifei Wang: „*PDM-microphone signal acquisition system for raspberry pi*", Assist. Prof. **M. Rupniewski** (supervisor), studies in English.

[BSc88] Maciej Wasiluk: *"Przenośny pulsoksymetr z układem scalonym serii MAX30102*" (Portable pulse oximeter with MAX30102 series integrated circuit), Assist. Prof. **G. Domański** (supervisor).

[BSc89] Justyna Weber: *"Jednokanałowe urządzenie do jednoczesnej rejestracji sygnałów EKG i PPG"* (Single-channel device for simultaneous recording of ECG and PPG signals), Assist. Prof. **G. Domański** (supervisor).

[BSc90] Damian Wichiciel: "*Budowa oraz implementacja stanowiska komputerowego do badania słuchu pod kątem stymulacji uwagi neurosensorycznej z wykorzystaniem przewodnictwa kostnego*" (Construction and implementation of a computer workstation for testing hearing for neurosensory attention stimulation using bone conduction), Assist. Prof. **A. Pietrzak** (supervisor).

[BSc91] Dorota Wlazło: "*Internetowy interfejs użytkownika dla bazodanowego systemu identyfikacji białek*" (Web-based database protein identification system user interface), Assist. Prof. **T. Rubel** (supervisor).

[BSc92] Mikołaj Wroński: „*Detekcja nadjeżdżających rowerów*" (Detection of oncoming cyclists), Assist. Prof. **T. Rubel** (supervisor).

[BSc93] Xinran Xao: "*Optimal path selection in the telecommunication network using the graph-based algorithm*", Assoc. Prof. **P. Bilski** (supervisor), studies in English.

[BSc94] Yiming Yao: "*Simulation of the routing protocols in the telecommunication network using the heuristic approach*", Assoc. Prof. **P. Bilski** (supervisor), studies in English.

[BSc95] Wei Yiwen: "*The development of Remote Control of the Measuring Instrument*", Assist. Prof. **K. Kuczyński** (supervisor), studies in English.

[BSc96] Li Yuanhao: "*IoT methods in detecting of mist with the use of camera and sensors set of humidity in air*", Assoc. Prof. **M. Borecki** (supervisor), studies in English.

[BSc97] Rafał Zan: "*System analizy danych pogodowych*" (Weather data analysis system), Assist. Prof. **K. Ignasiak** (supervisor).

[BSc98] Xinkai Zhang: "*Application of the compression coding methods in the telecommunication system*", Assoc. Prof. **P. Bilski** (supervisor), studies in English.

[BSc99] Shuqing Zhao: „Methods of the Internet of Things in the application to determine the color of the sky, taking into account the fusion of data from the camera and color sensor in extended bit resolution", Assoc. Prof. **M. Borecki** (supervisor), studies in English.

[BSc100] Zishuo Zhao: "The use of Kantorovitch distance in the analysis of control systems", Assoc. Prof. **P. Domański** (supervisor), studies in English.

[BSc101] Jiang Zhiyu: "Development of Remote-Control System for Testing Transducers", Assist. Prof. **K. Kuczyński** (supervisor), studies in English.

[BSc102] Qiushi Zuo: "Tail index measures in control engineering", Assoc. Prof. **P. Domański** (supervisor), studies in English.

[BSc103] Mateusz Zych: "*Analiza wpływu bodźca kontekstowego na dokładność lokalizacji przy binauralnym odsłuchu dźwięku ambisonicznego*" (Analysis of the influence of the contextual stimulus on the accuracy of localization in binaural listening of ambisonic sound), Assist. Prof. **A. Pietrzak** (supervisor).

[BSc104] Tomasz Żarnovsky: *"Model wieloparametrycznego biomedycznego czujnika typu wearable z komunikacją w standardzie Bluetooth"* (Model of a multi-parameter biomedical wearable sensor with communication in the Bluetooth standard), Assist Prof. **R. Kurjata** (supervisor).

6. PUBLICATIONS

6.1. Scientific and technical books, chapters in books

[Pub1] P. Bilski, J. Olejnik: "Zastosowania sztucznej inteligencji do przetwarzania danych multimedialnych w praktyce" (Applications of artificial intelligence for multimedia data processing in practice), in: Sztuczna Inteligencja i Prawo (*Artificial Intelligence And Low)* 2024, ISBN: 978-83-971600-5-7, pp. 21-41.

[Pub2] R. Z. Morawski: „Technoscientific Research: Methodological and Ethical Aspects" (2nd Edition), *Walter de Gruyter, Berlin & Boston 2024*, ISBN: 9783111180038;,DOI:10.1515/9783111180038, 551 pages.

[Pub3] K. M. Snopek: „Hands-on Signals and Systems Theory", *Springer Nature Switzerland 2024*, ISBN: 9783031560804, DOI: 10.1007/978-3-031-56081-1, 340 pages.

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 Education and Science 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.

[Pub4] F. Acerbi (….), A. Buchowicz, G. Galiński, G. Pastuszak (314 external authors): "A new hybrid gadolinium nanoparticles-loaded polymeric material for neutron de-tection in rare event searches", *Journal of Instrumentation*, vol. 19, 2024, doi: 10.1088/1748-0221/19/09/P09021, pp. 1-30.

[Pub5] F. Acerbi (….), A. Buchowicz, G. Galiński, G. Pastuszak (310 external authors): "DarkSide-20k sensitivity to light dark matter particles", *Communications Physics*, vol. 7, no. 422, 2024, doi: 10.1038/s42005-024-01896-z, pp. 1-9.

[Pub6] G. D. Alexeev, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (179 external authors): "Final COMPASS Results on the Transverse-Spin-Dependent Azimuthal Asymmetries in the Pion-Induced Drell-Yan Process", *Physical Review Letter*s, vol. 133, no. 7, 2024, doi: 10.1103/physrevlett.133.071902, pp. 1-8.

[Pub7] G. D. Alexeev, R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (132 external authors): "High-Statistics Measurement of Collins and Sivers Asymmetries for Transversely Polarized Deuterons", *Physical Review Letters*, vol. 133, no. 10, 2024, doi: 10.1103/physrevlett.133.101903, pp. 1-7.

[Pub8] A. Balcerak, L. Szafron, T. Rubel, B. Świderska, A. Bonna, M. Konarzewska, I. Sołtyszewski, J. Kupryjańczyk, Ł. Szafron.: "A Multi-Faceted Analysis Showing CRNDE Transcripts and a Recently Confirmed Micropeptide as Important Players in Ovarian Carcinogenesis", *International Journal of Molecular Sciences*, vol. 25, no. 8, 2024, doi: 10.3390/ijms25084381, pp. 1-28.

[Pub9] P. Bilski, R. Łabędzki, A. Bilski: "Prediction of the mobile game players' payments-related retention from the Big Data perspective", *International Journal of Electronics and Telecommunications*, vol. 70, no. 4, 2024, doi: 10.24425/ijet.2024.152510, pp. 1-7.

[Pub10] M. Borowska, K. Jankowski, M. Trzaskowski, W. Wojtasiak, P. Korpas, S. Kozłowski, D. Gryglewski: "Nucleation and growth of zinc-templated mesoporous selenium nanoparticles and potential non-thermal effects during their microwave-assisted synthesis", *Scientific Reports*, vol. 14, no. 1, 2024, doi:10.1038/s41598-024-83124-w, pp. 1-13.

[Pub11] M. Celuch, M. Olszewska-Placha, Ł. Nowicki, W. Gwarek: "A Novel Q-Choked Resonator for Microwave Material Measurements Alleviating Sample Thickness Limitations of Existing Techniques", *IEEE Microwave and Wireless Technology Letters*, vol. 34, no. 6, 2024, doi: 10.1109/LMWT.2024.3397912, pp. 845-848.

[Pub12] J. Cuper, B. W. Salski, P. Kopyt: "Conductivity measurements in the 10–40 GHz band using Fabry–Pérot open resonator", *Measurement*, vol. 226, 2024, doi: 10.1016/j.measurement.2024.114198, pp. 1-9.

[Pub13] M. Daniluk, A. P. Pietrzak: "Comparative Analysis of Natural and Synthesized Polish Speech", *International Journal of Electronics and Telecommunications*, vol. 70, no. 4, 2024, doi: 10.24425/ijet.2024.149553, pp. 361-366.

[Pub14] K. Derzakowski: *"*Resonant Frequencies of TE0mn modes in multilayered dielectric-ferrite resonators with complex shapes", *International Journal of Electronics and Telecommunications*, vol. 70, no. 1 2024, doi: 10.24425/ijet.2024.149537, pp. 247-252.

[Pub15] K. Derzakowski: "Resonant Frequencies of TE0mn modes in multilayered resonators containing uniaxial anisotropic dielectrics with complex shapes", *International Journal of Electronics and Telecommunications*, vol. 70, no. 3, 2024, doi: 10.24425/ijet.2024.149597, pp. 683-690.

[Pub16] M. Ivanenko, D. Wanta, W. Smolik, P. Wróblewski, M. Midura: "Generative-Adversarial-Network-Based Image

Reconstruction for the Capacitively Coupled Electrical Impedance Tomography of Stroke", *Life*, vol. 14, no. 3, 2024, doi: 10.3390/life14030419, pp. 1-20.

[Pub17] J. Jabłoński, M. Lewandowski: "Switching-mode audio amplifier based on a ΔΣ A/D converter", *International Journal of Electronics and Telecommunications*, vol. 70, no. 2, 2024, doi: 10.24425/ijet.2024.149545, pp. 301-306.

[Pub18] J. Jankowska, J. Gargas, K. Zajdel, M. Wieteska, K. Lipiński, M. Ziemka-Nałęcz, M. Frontczak-Baniewicz, J. Sypecka: "Oligodendrocyte progenitor cells' fate after neonatal asphyxia—Puzzling implications for the development of hypoxic–ischemic encephalopathy", *Brain Pathology*, 2024, doi: 10.1111/bpa.13255, pp. 1-23.

[Pub19] M. Kołakowski, V. Djaja-Jośko, J. Kołakowski, J. Cichocki: "Wrist-to-Tibia/Shoe Inertial Measurement Results Translation Using Neural Networks", *Sensors,* vol. 24, no. 1, 2024, doi: 10.3390/s24010293, pp. 1-16.

[Pub20] P. Korpas, M. Borowska (Bartosiak), M. Celuch, D. Gryglewski, K. Jankowski, S. Kozłowski, W. Wojtasiak: „ A Reactor for Microwave-Assisted Chemistry [Application Notes]", *IEEE Microwave Magazine*, vol. 25, no. 11, 2024, doi: 10.1109/mmm.2024.3408074, pp. 74-82.

[Pub21] A. Kozak, M. Ninghetto, M. Wieteska, M. Fiedorowicz, M. Wełniak-Kamińska, B. Kossowski, U. T. Eysel, L. Arckens, K. Burnat: „Visual training after central retinal loss limits structural white matter degradation: an MRI study", *Behavioral and Brain Functions*, 2024, vol. 20, no. 1, doi: 10.1186/s12993-024-00239-w, pp. 1-18.

[Pub22] S. Kozłowski, P. Korpas, W. Wojtasiak, M.Borowska (Bartosiak): „ Model-Based PID Tuning Method for a Reactor for Microwave-Assisted Chemistry", *Energies*, vol. 17, no. 18, doi:10.3390/en17184657, pp. 1-16.

[Pub23] A. Krajewski, P. Bilski, P.Witomski, P. Bobiński: "Assessment of the Ability for Early Detection of Newly Hatched Larvae of Hylotrupes bajulus L. Using the Acoustic Emission Method in Scots Pine Wood", *Bioresources*, 2024 vol. 19, no. 2, doi: 10.15376/biores.19.2.2092-2105, pp. 2092-2105.

[Pub24] J. Krupka, A. Pacewicz, P. Kopyt, B. W. Salski: "Measurements of the complex permittivity of low loss ferrites at millimeter wave frequencies", *Materials Research Bulletin*, vol. 179, 2024, doi: 10.1016/j.materresbull.2024.112994, pp. 1-8.

[Pub25] J. Krupka, X. Chen, X. Xu, B. Guo, H. Wang, H Wang, B. W. Salski, A. Pacewicz, P. Kopyt: „Thermal characterization of ceramic pills at millimeter waves with a TE01δ cavity resonator", *Materials Research Bulletin*, vol. 177, 2024 doi: 10.1016/j.materresbull.2024.112879, pp. 1-6.

[Pub26] J. Kryszyn, W. Smolik, D. Wanta, P. Wróblewski, M. Midura: "Comparison of openEHR open-source servers", *International Journal of Electronics and Telecommunications*, vol. 70, no. 1, 2024, doi: 10.24425/ijet.2024.149526, pp. 161-167.

[Pub27] M. Lewandowski, Q. Deng: „ EMD-based time-frequency analysis methods of audio signals", *International Journal of Electronics and Telecommunications*, vol. 70, no. 2, 2024, doi: 10.24425/ijet.2024.149548, pp. 323-329.

[Pub28] M. Lewandowski: "Estimating the first and second derivatives of discrete audio data", *EURASIP Journal on Audio Speech and Music Processing*, no. 31, 2024, doi: 10.1186/s13636-024-00355-5, pp. 1-16.

[Pub29] K. Lipiński, P. Bogorodzki: "Evaluation of Whole Brain Intravoxel Incoherent Motion (IVIM) Imaging", *Diagnostics*, vol. 14, no. 6, 2024, doi: 10.3390/diagnostics14060653, pp. 1-15.

[Pub30] Y. Liu, G. Wan, Ch. Wu, Y. Yashchyshyn, Y. Wang, L. Tu: "A calibration method for vector network analyzers using a line and three or more offset-reflect standards", *Frequenz*, vol. 78, no. 5-6, 2024, doi: 10.1515/freq-2023-0116, pp. 181 - 193.

[Pub31] P. Miazga: "Generalized Linear Network Analysis Method Based on the Transfer Scattering Approach", IEEE Transactions on Microwave Theory and Techniques, 2023, doi: 10.1109/tmtt.2023.3322543, pp. 1-9.

[Pub32] T. A. Miś: „Evolution of Antenna Radiation Parameters for Air-to-Plasma Transition", *Electronics (Switzerland),* vol. 13, no. 15, 2024, doi: 10.3390/electronics13153040, pp. 1-26.

[Pub33] R. Z. Morawski: „Application-oriented metamodel of measurement uncertainty", *Measurement*, 2024, vol. 225, doi: http://dx.doi.org/10.1016/j.measurement.2023.114044, pp. 1-8.

[Pub34] R. Z. Morawski: "Teaching measurement science and technology in the times of pervasive AI", *Measurement: Sensors*, 2024, doi: 10.1016/j.measen.2024.101315, pp. 1-4.

[Pub35] D. Mostowski, K. Jakubczak, P. Garbat: "Automated laser beam characterization using artificial intelligence (AI) for the predictive maintenance of lasers", *Optics and Laser Technology*, vol. 177, 2024, doi: 10.1016/j.optlastec.2024.111087, pp.1-16.

[Pub36] M. Ninghetto, M. Wieteska, A. Kozak, K. Szulborski, T. Gałecki, J. P. Szaflik, K. Burnat: "Motion-Acuity Test for Visual Field Acuity Measurement with Motion-Defined Shapes", *Journal of Visualized Experiments*, no. 204, 2024, doi: 10.3791/66272, pp. 1-16.

[Pub37] Ł. Nowicki, F. Monteverde, C. Nouvellon, M. Celuch, O. Douheret, W. Wojtasiak: “Fabrication and electrical characterization of carbon coating on a quartz wafer treated with nitrogen ion implantation”, *Materials Research Bulletin*, vol. 179, 2024, doi: 10.1016/j.materresbull.2024.112940, pp. 1-7.

[Pub38] G. Pastuszak: „Optimization of Multi-Symbol Architecture of the Entropy Coder for H.265/HEVC Video Encoders”, *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, vol. 44, no. 2, 2024, doi: 10.1109/tcad.2024.3437339, pp. 458 - 468.

[Pub39] O. I. Pavlov, O. Guseva, Y. Yashchyshyn, T. Narytnyk, V. Saiko, G. L. Avdeyenko: „Mathematical Modeling of FMCW Radar: Sounding Signal Simulation”, *Radioelectronics and Communications Systems*, vol. 66, no. 12, 2024, doi: 10.3103/s0735272722090011, pp. 648-657.

[Pub40] A. P. Pietrzak: „Azimuth and elevation errors in binaural reproduction of ambisonics sound”, Vibrations in Physical Systems, vol. 35, no. 2, 2024, doi: 10.21008/j.0860-6897.2024.2.03, pp. 1-8.

[Pub41] K. Pondel-Sycz: “Acoustic model for the classification of Polish vowels”, *Vibrations in Physical Systems*, vol. 35, no. 1, 2024, doi: 10.21008/j.0860-6897.2024.1.01, pp. 1-11.

[Pub42] K. Pondel-Sycz, A. Paula Pietrzak, J. Szymla: „End-To-End deep neural models for Automatic Speech Recognition for Polish Language”, *International Journal of Electronics and Telecommunications*, vol. 70, no. 2, 2024, doi: 10.24425/ijet.2024.149547, pp. 315-321.

[Pub43] K. Pondel-Sycz, P. Bilski: “System dedicated to Polish Automatic Speech Recognition - overview of solutions”, *Bulletin of the Polish Academy of Sciences-Technical Sciences,* vol. 72, no. 4, 2024, doi: 10.24425/bpasts.2024.149818, pp. 1-13.

[Pub44] Ł. Popek, R. Perz, P. Bilski: “Text-to-Image generative models for enhanced composite guitar production”, *Machines. Technologies. Materials,* vol. 18, no. 7, 2024, doi: 10.3390/en16010052, 234p.

[Pub45] D. Radomski, Z. Oscik, E. Dmoch-Gajzlerska, A. Szczotka: “Development of a Sexological Ontology”, *Sensors*, vol. 24, no. 21, 2024, doi: 10.3390/s24216968.

[Pub46] A. Romanowska, S. Marynowicz, T. Strachowski, K. Godziszewski, Y. Yashchyshyn, A. Racki, M. Baran, T. Ciuk, A. Chlanda: “Graphene Oxide Paper as a Lightweight, Thin, and Controllable Microwave Absorber for Millimeter-Wave Applications”, *IEEE Transactions on Nanotechnology*, vol. 23, 2024, doi: 10.1109/tnano.2024.3385092, pp. 329-337.

[Pub47] D. Rosołowski, D. Gryglewski, W. Wojtasiak, M. Kajczuk, J. Klocek: „On the design and linearization of transmitters for the LTE 450 base station”, *International Journal of Electronics and Telecommunications*, vol. 70, no. 3, 2024, doi: 10.24425/ijet.2024.149600, pp. 707-713.

[Pub48] B. W. Salski, A. Pacewicz, P. Czekała, P. Kopyt: “Characterization of Low-Loss Liquids With a Double-Concave Fabry–Perot Open Resonator in the 20–50-GHz Range”, *IEEE Transactions on Microwave Theory and Techniques*, 2023, doi: 10.1109/tmtt.2023.3308215, pp. 1-8.

[Pub49] M. Sikorska, G. Domański, M. Bamburowicz-Klimkowska, A. Kasprzak, A. M. Nowicka, M. Rużycka-Ayoush, I. P. Grudziński: “Studies on the thermal sensitivity of lung cancer cells exposed to an alternating magnetic field and magnesium-doped maghemite nanoparticles”, *Cancer Nanotechnology*, vol. 15, no. 38, 2024, doi: 10.1186/s12645-024-00276-0, pp. 1-21.

[Pub50] W. Skarbek: “Cross Entropy in Deep Learning of Classifiers Is Unnecessary—ISBE Error Is All You Need”, *Entropy*, vol. 26, no. 1, 2024, doi: 10.3390/e26010065, pp. 1-25.

[Pub51] A. Tempes (…), T. Rubel (18 external authors): “Autophagy initiation triggers p150Glued–AP-2β interaction on the lysosomes and facilitates their transport”, *Cellular and Molecular Life Sciences*, vol. 81, no. 218, 2024, doi: 10.1007/s00018-024-05256-6, pp. 1-25.

[Pub52] B. Valinoti (…), G. Pastuszak, M. Ziembicki, K. Dygnarowicz, G. Galiński, A. Buchowicz (12 external authors): “A SoC-FPGA based readout platform for the free-running AMBER data acquisition system”, *Nuclear Instruments & Methods in Physics Research Section A Accelerators, Spectrometers, Detectors and Associated Equipment,* vol. 1066, 2024, doi: 10.1016/j.nima.2024.169546, pp. 1-8.

[Pub53] D. Wanta, M. Ivanenko, w. Smolik, P. Wróblewski, M. Midura: “Real-Time Nonlinear Image Reconstruction in Electrical Capacitance Tomography Using the Generative Adversarial Network”, *Information*, vol. 15, no. 10, 2024, doi: 10.3390/info15100617, pp. 1-14.

[Pub54] C. Wu, Y. Wang, L. Tu, Y. Zhang, Y. Yashchyshyn: “Permittivity Measurement From 40 to 70 GHz Using a DC FPOR With a Fixed Specimen Holder and an Off-Axial Feed”, IEEE Transactions on Microwave Theory and Techniques, 2024, doi: 10.1109/tmtt.2023.3337429, pp. 1-9, early access.

[Pub55] X. Yan, F. Liu, W. Smolik, X. Dan, X. Hou: “Simulation Research on Breast Tumor Model Based on Magnetoacoustic Concentration Tomography of Magnetic Nanoparticles with Magnetic Induction”, *Progress In Electromagnetics Research C*, vol. 139,

2024, doi: 10.2528/PIERC23101901, pp. 197-209.

[Pub56] Y. Yashchyshyn, P. Tokarsky: "Using a metasurface to enhance the radiation efficiency of subterahertz antennas printed on thick substrates", *Scientific Reports*, vol. 14, no. 18167, 2024, doi: 10.1038/s41598-024-69296-5, pp. 1-16.

[Pub57] X. Zhou, P. Czekała, M. Olszewska-Placha, B. W. Salski, S. Zhang, P. Pedrow, S. Sablani, J. Tang: "Understanding microwave heating of oils", *Journal of Food Engineering*, vol. 375, 2024, doi: 10.1016/j.jfoodeng.2024.112039, pp.112039.

[Pub58] J. Żera: Profile Analysis: A framework for the study of auditory sound spectrum analysis", *International Journal of Electronics and Telecommunications*, vol. 70, no. 3, 2024, doi: 10.24425/ijet.2024.149583, pp. 587-595.

6.2.2. Part B

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

[Pub59] V. Djaja-Jośko, J. Tuchowski: „System do lokalizowania osób w pomieszczeniach z wykorzystaniem czujników podczerwieni" (Indoor localization system utilizing infrared sensors), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. 1, no. 4, (2024), doi: 10.15199/59.2024.4.32, pp. 157-160.

[Pub60] M. Kołakowski: „Metoda lokalizacji uwzględniająca charakterystyczne trajektorie ruchu" (Positioning method considering characteristic movement trajectories), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. 1, no. 4, (2024), doi: 10.15199/59.2024.4.30, pp. 149-152.

[Pub61] M. Kołakowski: „Selekcja węzłów poprzez minimalizację błędu lokalizacji w wąskich przejściach" (Anchor selection through positioning error minimization in narrow passages), *Przegląd Telekomunikacyjny – Wiadomości Telekomunikacyjne*, vol. 1 no. 4, (2024), doi: 10.15199/59.2024.4.17, pp. 99-102.

[Pub62] K. Kuczyński: „Magazynowanie energii w zasilaczach UPS" (Energy storage in UPS power supplies), Elektro.Info, vol. 227, no. 9, 2024, pp. 102-111.

[Pub63] K. Kuczyński: „Ograniczenie strat w transformatorach rozdzielczych – co możemy jeszcze zrobić?" (Reducing losses in distribution transformers – what else can we do?), Elektro.Info, vol. 222, no. 3, 2024, pp. 80-84.

[Pub64] T. A. Miś: „Geometria podwodnych dróg propagacji fal długich" (The geometry of water-submerged longwave propagation paths), *Przegląd Elektrotechniczny*, vol. 1, no.11,(2024), doi: 10.15199/48.2024.11.31, pp. 169-171.

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 *)

[Pub65] M. Celuch, Ł. Nowicki, M. Olszewska-Placha, W. Gwarek: "Towards a Robust BCDR Design for Out-of-Plane Permittivity Measurements", *Proc. of 25th International Microwave and Radar Conference (MIKON 2024),* (Wrocław, Poland, Jul. 1-4, 2024) pp. 334-336.

[Pub66] J. Cuper, B. W. Salski, A. Pacewicz, P. Kopyt: "Plano-Concave Fabry-Pérot Open Resonator for Measurements of Conductivity up to 70 GHz", Proc. of 25th International Microwave and Radar Conference (MIKON 2024), (Wrocław, Poland, Jul. 1-4, 2024) pp. 314-316.

[Pub67] V. Djaja-Jośko, J. Kołakowski: "Enhancing BLE-based positioning system performance with proximity sensors", *Proc. of the 32th Telecommunications Forum (TELFOR 2024)*, (Belgrade, Serbia, Nov. 26-27, 2024), pp. 1-4.

[Pub68] M. Kalisiak, M. Olszewska-Placha, W. Wiatr, P. Czekała, A. Lewandowski, B.W. Salski, Ł. Usydus: "Microwave Measurements of High-Loss Liquids with Transmission Line and Resonant Methods", *Proc. of 25th International Microwave and Radar Conference (MIKON 2024),* (Wrocław, Poland, Jul. 1-4, 2024), pp 337-339.

[Pub69] M. Kołakowski, S. B. Bader: "ML-based Short Physical Performance Battery future score prediction based on questionnaire data", Proc. of the 32th Telecommunications Fo-rum (TELFOR 2024), (Belgrade, Serbia, Nov. 26-27, 2024), pp. 1-4.

[Pub70] J. Koper, M. Celuch, M. Olszewska-Placha, P. Korpas: „Evaluation of Image Restoration Techniques for Dielectric Resonator Mapping of Materials", *Proc. of 25th International Microwave and Radar Conference (MIKON 2024),* (Wrocław, Poland, Jul. 1-4, 2024), pp. 228-231.

[Pub71] B. Kościug, P. Bilski: "Wydajne algorytmy bezpieczeństwa danych w internecie rzeczy" (Efficient data security algorithms for the Internet of Things) Mat. XV Konferencji Naukowej Systemy Pomiarowe w Bada-niach Naukowych i w Przemyśle (Proc. 15th Scientific Conference Measurement Systems in Research and in Industry) (Łagów, Poland, Jun. 9-12, 2024) pp. 47-50.

[Pub72] P. Mazurek: "Comparison of two approaches to data Fusion in system for action recognition based on data from ompulse-radar sensors and depth sensors", Proc. of the *XXIV World Congress (IMEKO 2024),* (Hamburg, Germany, Aug. 26-29, 2024).

[Pub73] T. A. Miś, M. Gruszczyński, A. Czubla, J. Modelski*:* "25th anniversary of RCN Solec Kujawski longwave radio station and the introduction of digital time signal in Poland"*, Proc. of the 4th URSI Atlantic Radio Science Meeting (URSI AT-RASC) 2024,* (Gran Canaria, Spain, May. 19-24, 2024), pp. 1-3.

[Pub74] T.A. Miś, M. Gołkowski, R. Moore, J. Modelski: „FSK radio communication below 3 kHz using HAARP ionospheric excitation", *Proc. of the 4th URSI Atlantic Radio Sci-ence Meeting (URSI AT-RASC) 2024, (Gran Canaria, Spain, May. 19-24, 2024)*, pp. 1-3.

[Pub75] T. A. Miś, M. Gruszczyński, A. Czubla, J. Modelski: "Preliminary tests of RF LW Polish digital time signal reception in Lithuania", *Proc. of 25th International Microwave and Radar Conference (MIKON 2024)*, (Wrocław, Poland, Jul. 1-4, 2024), pp. 356-359.

[Pub76] Ł. Nowicki, M. Celuch, W. Wojtasiak: "Investigation of the Electromagnetic Properties of Silicon Carbide in the mmWave Frequency Range Using Density Functional Theory", *Proc. of 25th International Microwave and Radar Conference (MIKON 2024)*, (Wrocław, Poland, Jul. 1-4, 2024), pp. 222-223.

[Pub77] A. Pacewicz, B. W. Salski, M. Krysicki: "Miniaturized Coaxial Coupling Enhances the Millimeter-Wave Q-Factor of Fabry-Perot Open Resonator for Dielectric Material Characterization", *Proc. of 25th International Microwave and Radar Conference (MIKON 2024),* (Wrocław, Poland, Jul. 1-4, 2024), pp. 215-217.

[Pub78] D. Ruciński, M. Krysicki, B. W Salski: "Comparison of artificial intelligence methods in extracting the permittivity of materials with Fabry-Perot open resonator", *Proc. of 25th International Microwave and Radar Conference (MIKON 2024),* (Wrocław, Poland, Jul. 1-4, 2024), pp. 232-237.

[Pub79] A. Rychter: "Multi-PMT modules for the WCTE, IWCD and Hyper-Kamiokande experiments", *Proc. 2024 IEEE Nuclear Science Symposium (NSS), Medical Imaging Conference (MIC) and Room Temperature Semiconductor Detector Conference (RTSD)*, (Tampa, USA, Oct. 26 – Nov. 2, 2024).

[Pub80] B. W. Salski, M. Olszewska-Placha, H. Ramberg: " Microwave Characterization of 3D Printed Layers with a Fabry-Perot Open Resonator", *Proc. of 25th International Microwave and Radar Conference (MIKON 2024),* (Wrocław, Poland, Jul. 1-4, 2024), pp. 224-227.

[Pub81] B. W. Salski, P. Czekała, P. Kopyt,: "Resonant microwave measurement of the electric conductivity of wires", *Proc. of 25th International Microwave and Radar Conference (MIKON 2024),* (Wrocław, Poland, Jul. 1-4, 2024), pp. 316-317.

[Pub82] B. W. Salski, P. Baprawski, M. Krysicki, P. Czekała, P. Kopyt: "Thermal characterization of a Fabry-Perot open resonator", *Proc. of 25th International Microwave and Radar Conference (MIKON 2024),* (Wrocław, Poland, Jul. 1-4, 2024), pp. 330-333.

[Pub83] J. Wagner: "The use of Kalman in human gait analysis using depth sensors", Proc. of the *XXIV World Congress (IMEKO 2024),* (Hamburg, Germany, Aug. 26-29, 2024).

[Pub84] M. Wiśniewski, W. Wojtasiak: „On the Design of Selected Microwave Circuits with Non-Uniform Transmission Lines", *Proc. of 25th International Microwave and Radar Conference (MIKON 2024*), (Wrocław, Poland, Jul. 1-4, 2024), pp. 147-152.

6.4. Abstracts, posters and presentations

[Pub85] G. Bogdan, Y. Yashchyshyn: "Analog Beam Steering Without Phase Shifters Enabled by Periodic Modulation", 25th In-ternational Microwave and Radar Confer-ence (MIKON 2024), (Wrocław, Poland, Jul. 1-4, 2024).

[Pub86] K. Godziszewski, Y. Yashchyshyn: "Reflection-Only Method for Characterization of Lossy Dielectrics in Sub-THz Range", *25th International Microwave and Radar Conference (MIKON 2024),* (Wrocław, Poland, Jul. 1-4, 2024).

[Pub87] R. Z. Morawski: "Teaching measurement science and technology in the Times of pervasive AI", *XXIVth World Congress (IMEKO 2024),* (Hamburg, Germany, Aug. 26-29, 2024).

[Pub88] A. P. Pietrzak, A. Krawczyk: "Choristers intonation accuracy in different monitoring conditions: speaker, open headphones, closed headphones", *156th AES Europe Convention 2024*, (Madrit, Spain, Jun. 15-17, 2024).

[Pub89] A. P. Pietrzak: "Prediction of Noise-Induced Permanent Threshold Shift (NIPTS) for classical musicians: LEX,8h measurement-based analysis among music students", *156th AES Europe Convention 2024*, (Madrit, Spain, Jun. 15-17, 2024).

[Pub90] K. Pondel-Sycz: "Testing the robustness of the Whisper model to various types of noise in the speech signal", National Student Conference of Acousticians, OSKA 2024 (Cracow, Poland, Mar. 7-10, 2024).

[Pub91] Ł. Popek: "Text-to image generative models for enhanced composite guitar production", *17th International Conference for Young Researchers „Technical science. Industrial management 2024*, (Varna, Bulgaria, Sep. 4-9, 2024).

[Pub92] J. Szymla, K. Pondel-Sycz, A. P. Pietrzak: "Evaluating the Impact of Speech Signal Retoration on ASR Performance: A Comparative Study of Speech-Transformer and Conformer Architectures in Polish Language Recognition", *156th AES Europe Convention 2024*, (Madrit, Spain, Jun. 15-17, 2024).

[Pub93] M. Zych, A. P. Pietrzak: “Impact of Contextual Stimulus and Training on Sound Source Localization Accuracy in Binaural Ambisonic Reproduction”, *156th AES Europe Convention 2024*, (Madrit, Spain, Jun. 15-17, 2024).

7. RESEARCH REPORTS

[Rep1] P. Bajurko: “Badanie parametrów rozproszenia anten na pasmo E” (Examination of E-band antenna scatter-ing parameters), Final report for the Thorium Space S.A, Feb. 2024.

[Rep2] K. Kurek: “Opracowanie wstępnej koncepcji czujnika RF do detekcji pobrania regolitu przez łopatkę robota” (Developing of the preliminary concept of the RF sensor to detect the regolith in-side the excavator shovel), Final report for the CBK PAN, Apr. 2024.

[Rep3] Y. Yashchyshyn, P. Bajurko, J. Sobolewski: “Innowacyjne optyczne/quasi optyczne techniki oraz inżynieria nanomateriałów i materiałów anizotropowych dla opracowania struktur czynnych z zasadniczo poprawioną efektywnością energetyczną” (Innovation optical/quasioptical technologies and nano-engineering of anisotropic materials for creating active cells with substantially improved energy efficiency), Final report for the EU Framewor Programme for Innovative Training Networks, Jul. 2024.

[Rep4] G. Bogdan: “Przeprowadzenie badania nadajnika oraz opracowanie wykresu charakterystyk kie-runkowych” (Measurements of a transmitter and preparation of its directional patterns), Final report for the Advanced Protection Systems S.A., Jul. 2024.

[Rep5] G. Bogdan: “Przeprowadzenie pomiarów anteny TX PA00253 w komorze antenowej i opracowanie charakterystyki kierunkowej ekwiwalentnej mocy promieniowanej izotropowo (EIRP) modułu nadawczego z anteną TX PA00253” (Measurements of TX PA00253 antenna in the anechoic chamber and preparation of directional patterns in terms of the equivalent isotropically radiated power (EIRP)), Final report for the Advanced Protection Systems S.A., Jul. 2024.

[Rep6] K. Kurek: “Walidacja pomiarowa metody detekcji ilości regolitu z wykorzystaniem czujnika RF” (Measurement validation of the regolith quantity detection method using the RF sensor), Final report for the CBK PAN, Oct. 2024.

[Rep7] R. Z. Morawski: “Wykrywanie upadków osób w systemie monitoringu opartym na impulsowych czujnikach radarowych” (Detection of persons' falls by means of a monitoring system based on impulse-radar sensors), Final report for the Scientific Council for Biomedical Engineering, WUT, Warsaw, Nov. 2024.

[Rep8] D. Wanta: “Metoda wyznaczania pojemności kontaktu elektrody ze skórą w pomiarach medycznej elektrycznej tomografii pojemnościowej” (Method for determining the electrode-skin contact capacitance in medical electrical capacitive tomography measurements), Final report for the Scientific Council for Biomedical Engineering, WUT, Warsaw, Nov. 2024.

[Rep9] P. Wróblewski: “Metody wyznaczania za pomocą Spektroskopii Magnetycznej Nanocząstek (MPS) stosunku związanych nanocząstek superparamagnetycznych (MNP)” ([Pro28] Methods for determining the ratio of bound superparamagnetic nanoparticles (MNPs) using Magnetic Nanoparticle Spectroscopy (MPS)), Final report for the Scientific Council for Biomedical Engineering, WUT, Warsaw, Nov. 2024.

[Rep10] J. Kołakowski, V. Djaja-Jośko J. Cichocki, M. Kołakowski: “Zintegrowana platforma inkluzywnej opieki nad osobami starszymi oparta na monitorowaniu zdolności wewnętrznych” (Integrated Care Platform Based on the Monitoring of Older Individual Intrinsic Capacity for Inclusive Health (CAREUP), Final report for the National Centre for Research and Development, Warsaw, Nov. 2024.

[Rep11] B. Salski: „Standaryzacja pomiaru własności dielektrycznych materiałów na potrzeby technologii 5G” (Standardize the measurement of dielectric properties of materials for 5G), Final report for the Polish-Metrology, Warsaw, Dec. 2024.

8. PATENTS AND PATENT APPLICATIONS

[Pat1] D. Wanta, W. Smolik, O. Makowiecka, J. Kryszyn, P. Wróblewski, M. Midura, G. Domański: „Sposób pomiaru impedancji bioelektrycznej z użyciem suchych elektrod” (Method for measuring bioelectrical impedance using dry electrodes), patent application no. P.448046, Mar. 20, 2024.

[Pat2] R. Łukaszewski, K. Dowalla, R. Kowalik, A. Wójcik: „Urządzenie i sposób do detekcji zmiany trybu pracy oraz identyfikacji odbiorników elektrycznych” (Device and method for mode change detection and identification of electrical loads), patent application no. P.449468, Aug. 7, 2024.

9. SCIENTIFIC EVENTS

9.1. Scientific events co-organized by the Institute

[Con1] *11th Microwave & Radar Week: MRW 2024* with parallel conferences: *25th International Microwave and Radar Conference: MIKON 2024*, and *2024 International Radar Symposium* (Wrocław, Poland, Jul. 1-4, 2024), J. Modelski (General Chair of *MRW 2024*), M. Krysicki, J. Cuper (members of the Organizing Committee), P. Kopyt, B. Salski, W. Wojtasiak, Y. Yashchyshyn (members of the Technical Programme Committee – *MIKON 2024), G. Bogdan (participant), T. A. Miś (speaker).*

9.2. International scientific events

[Con2] 4th URSI Atlantic Radio Science Meeting - URSI AT-RASC 2024, (Gran Canaria, Spain, May 19-24, 2024), J. Modelski (Member Committee), T.A. Miś (speaker).

[Con3] AES 4th International Conference on Audio and Music Induced Hearing Disorders 2024 (Copenhagen, Denmark, May 29-31, 2024), A. P. Pietrzak (speaker).

[Con4] IEEE/MTT-S International Microwave Symposium - IMS 2024, (Washington, USA, Jun. 16-21, 2024), J. Modelski (MTT-S observer), P. Kopyt, A. Pacewicz (participants).

[Con5] *156th AES Europe Convention 2024, (Madrit, Spain, Jun. 15-17, 2024), A. P. Pietrzak, K. Pondel-Sycz (speakers).*

[Con6] *SUMMER SCHOOL – International Travelling Summer School on Terahertz Science and Technology (ITSS-TSaT)* (Vilnius, Lithuania, Jul. 14-18, 2024), Y. Yashchyshyn (speaker).

[Con7] *XXIV World Congress (IMEKO 2024),* (Hamburg, Germany, Aug. 26-29, 2024), R. Z. Morawski, P. Mazurek, J. Wagner (speakers).

[Con8] *17th International Conference for Young Researchers - Technical science. Industrial management 2024, (Varna, Bulgaria, Sep. 4-9, 2024), Ł. Popek (speaker).*

[Con9] *2024 European Microwave Conference (EuMC 2024)* (Paris, France, Sep. 24-26, 2024), J. Modelski (member of the Programme Committee).

[Con10] *32th Telecommunications Forum (TELFOR 2024),* (Belgrade, Serbia, Nov. 26-27, 2024), V. Djaja-Jośko, J. Kołakowski, M. Kołakowski (speakers).

[Con11] *2024 IEEE Nuclear Science Symposium (NSS), Medical Imaging Conference (MIC) and Room Temperature Semiconductor Detector Conference (RTSD), (Tampa, USA, Oct. 26 – Nov. 2, 2024),* A. Rychter (speaker).

9.3 National scientific events

[Con12] *Joint Seminar of the Faculty of Administration and Social Sciences at Warsaw University of Technology, the Faculty of Philosophy at University of Warsaw, and the Institute of Philosophy and Sociology at Polish Academy of Sciences* (Warsaw, Jan. 25, 2024), R. Z. Morawski: "Mathematical modelling vs. computational process – Instrumentalist perspective" (speaker).

[Con13] Ogólnopolska Studencka Konferencja Akustyków, OSKA 2024 (National Student Conference of Acousticians), (Cracow, Poland, Mar. 7-10, 2024), M. Jasiński, A. P. Pietrzak (Scientific Committee), K. Pondel-Sycz (speaker).

[Con14] *II Konferencja Radiokomunikacji i Teleinformatyki: KRiT 2024 (2nd Radiocommunication and Teleinformatics Conference)*, (Poznań, Poland, Sep. 11-13, 2024), J. Modelski, G. Pastuszak, K. Snopek, W. Wojtasiak, Y.Yashchyshyn (members of the Programme Committee), V. Djaja-Jośko, M. Kołakowski (speakers), J. Kołakowski (participant).

[Con15] *LXX Otwarte Seminarium z Akustyki (LXX Open Seminar on Acoustics)*, (Pułtusk, Poland, Sep. 16-20, 2024), M. Jasiński, K Pondel-Sycz, J. Żera (participants).

[Con16] *XX Międzynarodowe Sympozium Nowości w Technice Audio i Wideo NATV 2024 (20th International Symposium News in Audio and Video Technologu)*, (Wrocław, Poland, Oct. 17-19, 2024), A. P. Pietrzak, J. Żera (Scientific Committee), M. Lewandowski (participants).

10. AWARDS AND DISTINCTIONS

State Medals

Przemysław Miazga, Ph.D.,
Mirosław Mikołajewski, Ph.D.
Medal Komisji Edukacji Narodowej (Medal of the National Education Committee).

Awards of the Rector

Krzystof Derzakowski, D.Sc.
Individual II^{o} award for the scientific achievements.

Marcin Kołakowski, Ph.D.,
Individual III^{o} award for the scientific achievements.

Tomasz A. Miś, Ph.D.,
Individual III^{o} award for the scientific achievements.

Jakub Sobolewski, Ph.D.,
Individual III^{o} award for the scientific achievements.

Jerzy Kołakowski, Ph.D.
Individual III^{o} award for the teaching achievements.

Bartłomiej W. Salski, D.Sc.,
Paweł Kopyt, D.Sc.,
Jerzy Krupka, Prof. D.Sc.,
Adam Pacewicz, Ph.D.,
Piotr Czekała, M.Sc.,
Jerzy Cuper, M.Sc.,
Mateusz Krysicki, M.Sc.
Team I^{o} award for the scientific achievements.

Władysław Skarbek, Prof. D.Sc.,
Grzegorz Gwardys, M.Sc.,
Xin Chang, Ph.D.,
Team I^{o} award for the teaching achievements.

Jan Żera, Prof. D.Sc.,
Marcin Lewandowski, Ph.D.,
Agnieszka P. Pietrzak, Ph.D.,
Karolina Pondel-Sycz, M.Sc.,
Team II^{o} award for the organizational achievements.

Awards granted by international bodies

Prof. Roman Z. Morawski has been listed in the World's TOP 2% Scientists 2023 ranking, prepared by Stanford University in cooperation with Elsevier Publishing House and SciTech Strategies company.

Awards granted by national bodies

Daniel Mostowski, M.Sc.

Siemens and PW Award

IIIrd award for the project "Recommendation systems for laser beam diagnostics based on artificial intelligence algorithms" (Systemy rekomendacyjne do diagnostyki wiązki laserowej oparte na algorytmach sztucznej inteligencji).

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

Marcin Kołakowski, Ph.D.
Ist award for the Ph.D. dissertation titled: *"Adaptive Method for Indoor Positioning of Moving Objects"* supervisor: **Józef Modelski, Prof. D.Sc.,** II Konferencja Radiokomunikacji i Teleinformatyki: KRiT 2024 (2nd Radiocommunication and Teleinformatics Conference), (Poznań, Poland, Sep. 11-13, 2024)

Scholarships of the Foundation for the Development of Radiocommunications and Multimedia Technologies granted in 2024.

Paweł Rurka
Karol Duszczyk
Jan Ronda
Katarzyna Stec
Michał Borkowski
Patrycja Krankowska
For preparing B.Sc. thesis.

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

SPECIFICATION	2021	2022	2023	2024
academic staff [posts] total	54,5	58,75	58,9	**58,45**
Full professors	5,5	6,5	6,5	**6**
University professors	8	7	7	**7**
associate professors	1	1	2	**2**
assistant professors	31,5	38,25	39,4	**38,95**
readers	0	0	0	**0**
senior lecturers	0	0	0	**0**
assistants	9,5	7	6	**4,5**
Ph.D. students [persons] total	26	24	31	**24**
technical and administrative staff [posts] total	14,7	12,5	12,5	**13**
senior R&D associates	2	0	0	**0**
R&D associates	3,5	2	1	**1**
administrative associates	5,2	8	9	**10**
service workers	2	2	2	**2**
temporary staff [persons]	2	0,5	0,5	**0**
teaching activities basic courses	75	81	72	**82**
advanced courses	40	36	32	**38**
other courses	13	8	9	**9**
international projects, courses and lectures	2	6	4	**3**
research projects total	42	33	43	**30**
International granted by EU	3	2	3	**3**
granted by the Ministry	14	13	13	**8**
granted by the University	13	12	14	**11**
other	12	6	13	**8**
titles and degrees awarded Prof. titles	0	1	0	**0**
D.Sc. degrees	0	0	1	**0**
Ph.D. degrees	5	2	6	**0**
M.Sc. degree (regular studies + evening studies)	26	32	32	**29**
M.Sc. degree (studies in English)	0	0	5	**6**
B.Sc. degrees (regular studies + evening studies)	71	51+1	62	**104**
B.Sc. degrees (studies in English)	0	2	7	**24**
publications total	71	101	91	**93**
sci.-tech. books and chapters in books	1	5	5	**3**
sci.-tech. papers in journals - total	42	62	57	**61**
JCR-ICI list (IF>0)	37	59	57	**61**
in other journals	5	3	0	**0**
sci.-tech. papers in conference proceedings	17	32	18	**20**
other publications	11	2	11	**9**
patents and patent applications	3	3	9	**2**
international	3	1	1	**0**
national	0	2	8	**1**
research reports	19	3	16	**11**
scientific events attended by the staff	19	23	20	**16**

APPENDIX:

EXPLANATORY NOTE ON POLISH ACADEMIC AND PROFESIONAL TITLES, DEGREES AND POSTS

This note contains the definitions of academic and professional titles, degrees and posts held by the staff of the Institute of Radioelectronics and Multimedia Technology.

The following professional titles are awarded by Polish higher-education institutions:

- the ***inżynier (inż.)*** title, translated here as **B.Sc.**, is awarded to the students completing undergraduate studies in the fields of study related to engineering and technology;
- the ***magister (mgr)*** title, translated here as **M.Sc.**, is awarded to the students completing graduate studies in the fields of study related to sciences;
- the ***magister (mgr)*** title, translated here as **M.A.**, is awarded to the students completing graduate studies in arts and humanities;
- the ***magister inżynier (mgr inż.)*** title, translated here as **M.Sc.**, is awarded to the students completing graduate studies in the fields of study related to engineering and technology.

The academic degrees, the *doctor* and *doctor habilitowany* degrees, are awarded by the scientific councils of higher-education institutions or other scientific institutions.

The degree of ***doktor (dr)***, translated here as **Ph.D.**, is conferred on a person who:

- is the holder of the professional title of *magister* or *magister inżynier*;
- has successfully passed doctoral examinations in a selected research discipline;
- has submitted and successfully defended a doctoral thesis, favorably assessed by two reviewers.

The doctoral thesis, prepared under the supervision of a research adviser, should provide an original solution of a research problem and demonstrate general theoretical knowledge of the candidate in a given research discipline, as well as confirm his/her skills to conduct research work autonomously.

The degree of ***doktor habilitowany (dr hab.)***, translated here as **D.Sc.**, is conferred on a person who:

- is the holder of the academic degree of *doktor*;
- has remarkable scientific achievements;
- has significantly contributed to the development of a given research discipline;

and his/her contribution has been favorably assessed by four reviewers and approved by the scientific council of a higher-education institution or other scientific institution. The holder of the *doktor habilitowany* degree is authorized to be the advisor of Ph.D. students.

The academic title of ***profesor (prof.)*** is conferred by the President of the Republic of Poland. This title may be conferred on a person who:

- is the holder of the degree of *doktor habilitowany*;
- has scientific achievements significantly exceeding those required of *doktor habilitowany*;
- has remarkable academic achievements, including formation of academic staff.

The combination of the *profesor* title and the *doktor habilitowany* degree (***professor doktor habilitowany – prof. dr hab.***) is translated here as **Prof. D.Sc.**

The minimum requirements concerning the academic posts are as follows:

- for the post of ***asystent****,* translated here as ***Assistant*** − the professional title of *magister* or *magister inżynier*;
- for the post of ***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 addendmends)