name of the unit:

TELECOMMUNICATION DIVISION – WIRELESS BODY AREA NETWORKS

Institute of Electronics, Lodz University of Technology

symbol:

I-23

http://www.tele.p.lodz.pl

head of the unit:	potential promoters:	contact person:
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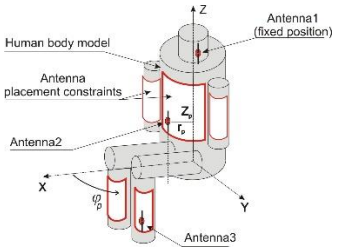
scope of activities:

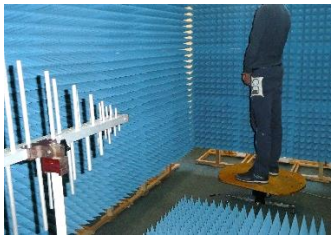
Wireless systems operating in the proximity of human body (the so-called Wireless Body Area Networks - WBANs) enable the transfer of data between devices placed close to the body. They include a wide variety of solutions, from the most popular, commonly used, for example, for monitoring the course of training by people practicing sports, to specialized diagnostic systems used in medicine. Research work on such systems covers many aspects. These include the development of physical and numerical models of the human body to determine the impact of electromagnetic waves on the body as well as human influence on the functioning of the wireless system. In addition, the research also concerns the optimization of the topology of such systems by the selection of the number of system nodes and their spatial arrangement. In the case of such systems, it is also important to design wearable antennas that can function properly being placed close to the human body.

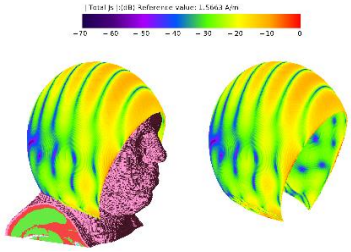
present activities:

- Development of numerical models for computationally efficient simulation of the influence of electromagnetic waves on the body.
- Development of physical models to study the parameters of wireless systems operating in the vicinity of the body.
- Development of computer methodology for optimization of wireless systems operating in the vicinity of the body with the use of numerical simulations of the electromagnetic field and evolution algorithms.
- Optimization of wearable antenna arrays.
- Design and optimization of wearable textile antennas.
- Investigation of the impact of 5G systems radiation on the human body.
- Design of structures shielding the body against radiation from base stations.

graphic material







Future activities:

- Application of artificial intelligence algorithms to model wireless systems operating near the human body.
- Development of broadband structures shielding the human body against electromagnetic radiation

Publications:

1. Januszkiewicz, Ł.; Barba, P.D.; Kawecki, J. Design Optimization of Wearable Multiband Antenna Using Evolutionary Algorithm Tuned with Dipole Benchmark Problem. Electronics 2021, 10, 2249. https://doi.org/10.3390/electronics10182249
2. Januszkiewicz, Ł. Analysis of Shielding Properties of Head Covers Made of Conductive Materials in Application to 5G Wireless Systems. Energies 2021, 14, 7004. https://doi.org/10.3390/en14217004
3. Januszkiewicz, Ł.; Di Barba, P.; Hausman, S. Optimal Design of Switchable Wearable Antenna Array for Wireless Sensor Networks. Sensors 2020, 20, 2795. https://doi.org/10.3390/s20102795
4. Januszkiewicz, Ł.; Hausman, S.; Barba, P.D. Human Body Modelling for Wireless Body Area Network Optimization. 2020 14th European Conference on Antennas and Propagation (EuCAP), Copenhagen, Denmark, 2020, pp. 1-5
5. Januszkiewicz, Ł. Analysis of Human Body Shadowing Effect on Wireless Sensor Networks Operating in the 2.4 GHz Band. Sensors 2018, 18, 3412. https://doi.org/10.3390/s18103412

Patents:

1. Łukasz Januszkiewicz, Sławomir Hausman, Tomasz Kacprzak, Jadwiga Bilska, Marina Michalak, Izabella Krucińska, Pat.216923, „Antena tekstylna", udzielenie: 30.05.2014, WUP 05/14
2. Łukasz Januszkiewicz, Ewa Skrzetuska, Izabella Krucińska, Pat.228966, „Sposób wykonania połączenia elektrycznego między ścieżkami elektroprzewodzącymi wykonanymi na podłożu tekstylnym i przewodami elektrycznymi", udzielenie: 30.05.2018, WUP 05/18
3. Izabella Krucińska, Ewa Skrzetuska, Sławomir Hausman, Łukasz Januszkiewicz, Pat.235486 , „Tekstylny czujnik do monitorowania częstotliwości oddechu", udzielenie: 24.04.2020, WUP 12/2020

Keywords:

Wireless communication, antennas, numerical modeling, CEM, microwave technique

List of internship proposal in this research team:

- Development of WBAN optimization methods that utilize artificial intelligence algorithms.
- Development of structures shielding the body against electromagnetic radiation