



CONNECTING BUSINESS AND SCIENCE

14th Edition of Innovator of Masovia Contest

#MAZONOWSZE

INNOVATOR
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serce Polski

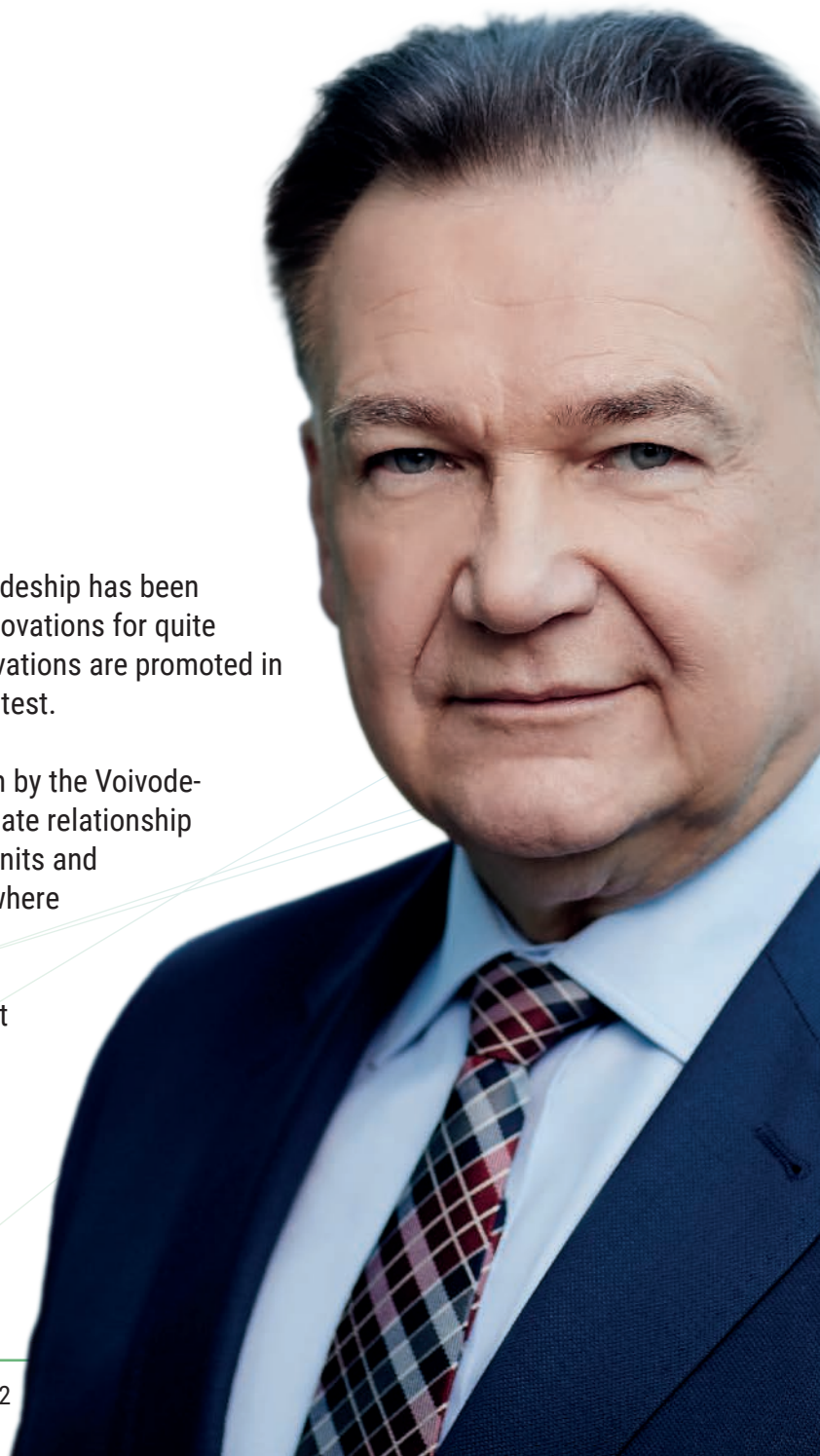
KNOWLEDGE INNOVATION COOPERATION



Ladies and Gentlemen,

The governance of the Mazowieckie Voivodeship has been striving to shape an approach open for innovations for quite some time. One of the ways in which innovations are promoted in the region is the Innovator of Mazovia Contest.

As part of an array of activities undertaken by the Voivodeship, we aim to support innovations, facilitate relationship building between research and scientific units and enterprises, and develop an environment where innovations can grow and foster.

This year's competition has highlighted not only the ties connecting the worlds of science and business but also served to show how compatible these areas are. Commercial growth depends on the implementation of innovations which have solid roots in knowledge, education, and research and development.





Development and absorption of innovations are the basis of the knowledge-based economy and is the cornerstone of the Cohesion Policy in the Mazowieckie Voivodeship as well as in the regions of the European Union.

The success of Masovian companies is based on cooperation with the world of science, which is why the Masovian Voivodeship makes efforts to strengthen this area.

The competition is possible thanks to the cooperation of various entities, and I would like to express my gratitude to all contributing institutions and persons, jury, experts, and partners.

I encourage you to go through this booklet and get to know the winners of the XIV edition of Innovator of Masovia Contest.

Connecting business and science,



Marshal of Mazowieckie Voivodeship

Innovator of Masovia Contest

supports and promotes the most interesting innovations from the Mazowieckie Voivodeship. The idea driving the competition is to create cooperation between science, business, and local government for Mazowieckie Voivodeship.

Winners of the competition will benefit from the financial awards, recognition, and a chance to establish business relationships and enter into cooperation with science, business and local government partners.

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The competition is divided into two categories

Innovative Company

The **Innovative Company** category is addressed to the representatives of micro, small, and medium enterprises, which operate as autonomous companies and are registered and running their operations in Mazowieckie Voivodeship. Moreover, the innovative product, technology, or service in question has already been introduced into the company's operations or is ahead of the sale stage, and funds have been acquired to commercialize the innovative assets.

Innovative Scientist

The **Innovative Scientist** category is addressed to scientists, who have completed their doctoral dissertations or have obtained their doctoral degrees, and have worked on their doctorates or who defended their dissertations at research units based in Mazowieckie Voivodeship. The subjects of doctoral dissertations submitted for evaluation should focus on innovative solutions, which can be implemented into business practice.

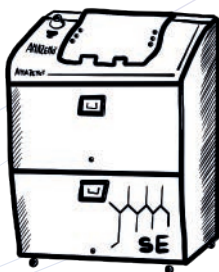
INNOVATIVE COMPANY CATEGORY





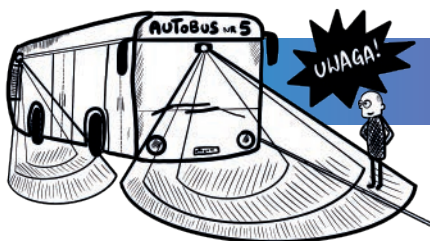
I Place – 30 000 zł

BD Polska sp. z o.o. for the Virtual Clinic platform



II Place – 20 000 zł

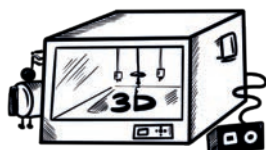
AMAZEMET sp. z o.o. for the safeEtch Application



III Place – 15 000 zł

Autonomy Now sp. z.o.o. for the ADAS System

WYRÓŻNIENIA:



Sygnis S.A.
for the F-NIS 23151
3D printer

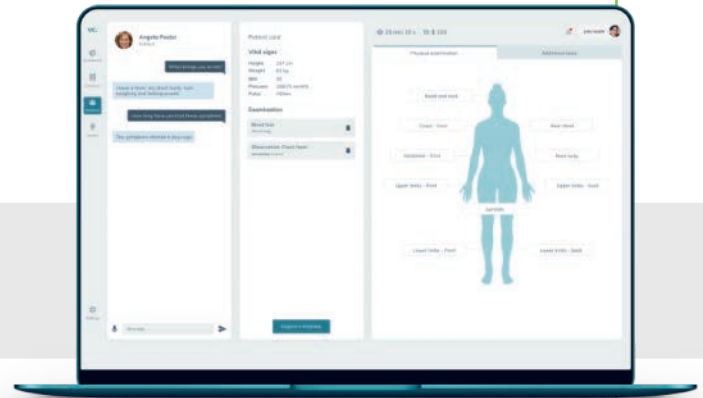


Amargo sp. z o.o. sp. kom
for theChemo-resistant tank
made using non-pressure
technology. AmargTANK
SafeSeamLess

I place



Virtual Clinic



A Virtual Clinic is an intelligent educational platform which supports medical training through the practice of diagnosing and designing treatment. The solution enables users to improve their medical skills based on problem-solving and case-by-case analysis.

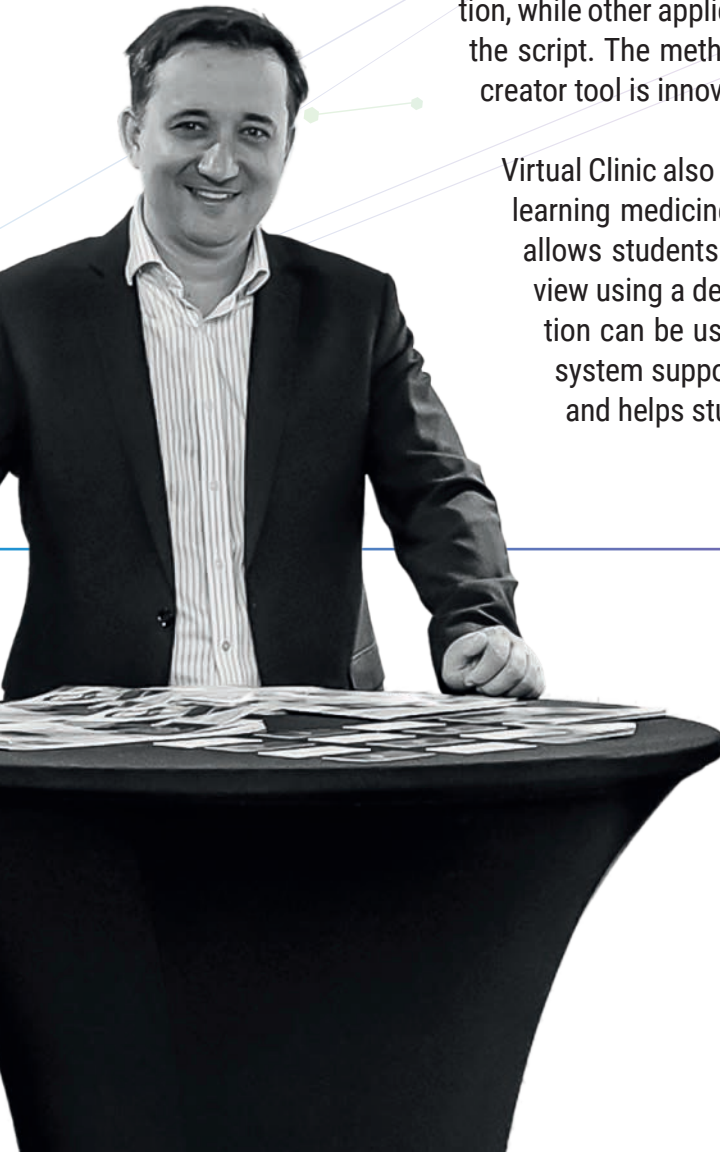
The solution boasts the following features:

- Users can be in touch with patients with symptoms of any chosen disease,
- Interactive communication using natural language (including spoken Polish language),
- Creator allows university staff to design diseases and ailments based on a knowledge hub which includes: 150 thousand patient features, 50 thousand test results, 21 thousand medications,
- Intelligent algorithm creates unique patients based on the rules stored in the knowledge hub and on models that randomly assign features and test results.

The platform is based on a large amount of data and makes use of AI, knowledge based on data and artificial intelligence. The system has been designed so that each interaction with the user improves the communication algorithm and suggestions given by the application.

The product introduces a groundbreaking solution in the field of educational apps for medics. The system allows students to pose any question, while other applications limit their choice to questions included in the script. The method of creating diseases and ailments using the creator tool is innovative as well.

Virtual Clinic also fills the gap caused by the lack of contact people learning medicine might have with real-life patients. The system allows students to carry out a supervised medical history interview using a desktop computer or a mobile device. The application can be used by multiple people and is easy to scale. The system supports the teaching process at medical universities and helps students and trainee doctors improve their skills.



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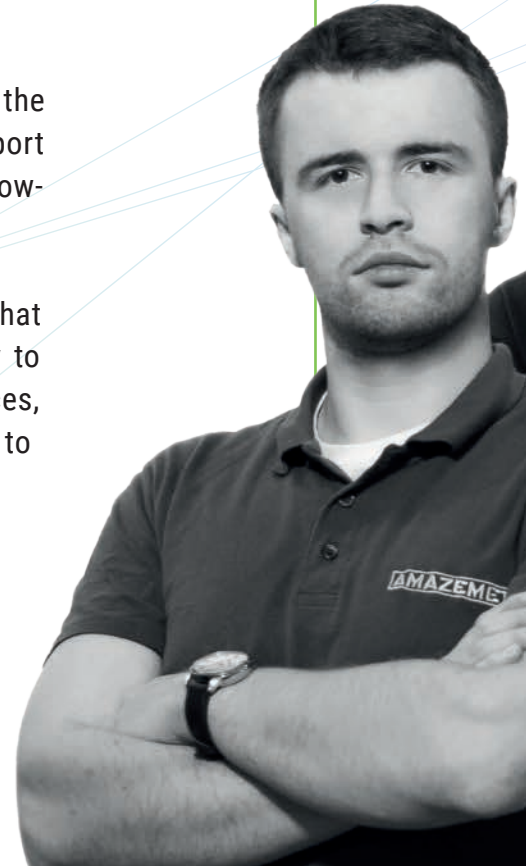
II place



safeEtch Application

SafeEtch technology is innovative because it automatizes the processing of metal 3D prints - such as the removal of support structures, surface treatment, and removal of loose adhesive powders.

Thanks to safeEtch technologies you can create geometries that were previously unattainable, due to, for example, the inability to achieve subsequent subtractive manufacturing (enclosed spaces, walls perpendicular to the floor) and excludes the necessity to account for support structures.



The technology addresses the need to use scaffolding structures (manufactured using the same materials as the final product). The structures are necessary to dissipate heat from the melted layers.

Moreover, this technology complements Industry 4.0 idea when it comes to the automatization of the production process. SafeEtch is a repetitive process giving an opportunity for automatization and validation of the process of manufacturing of specialized parts.



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III place

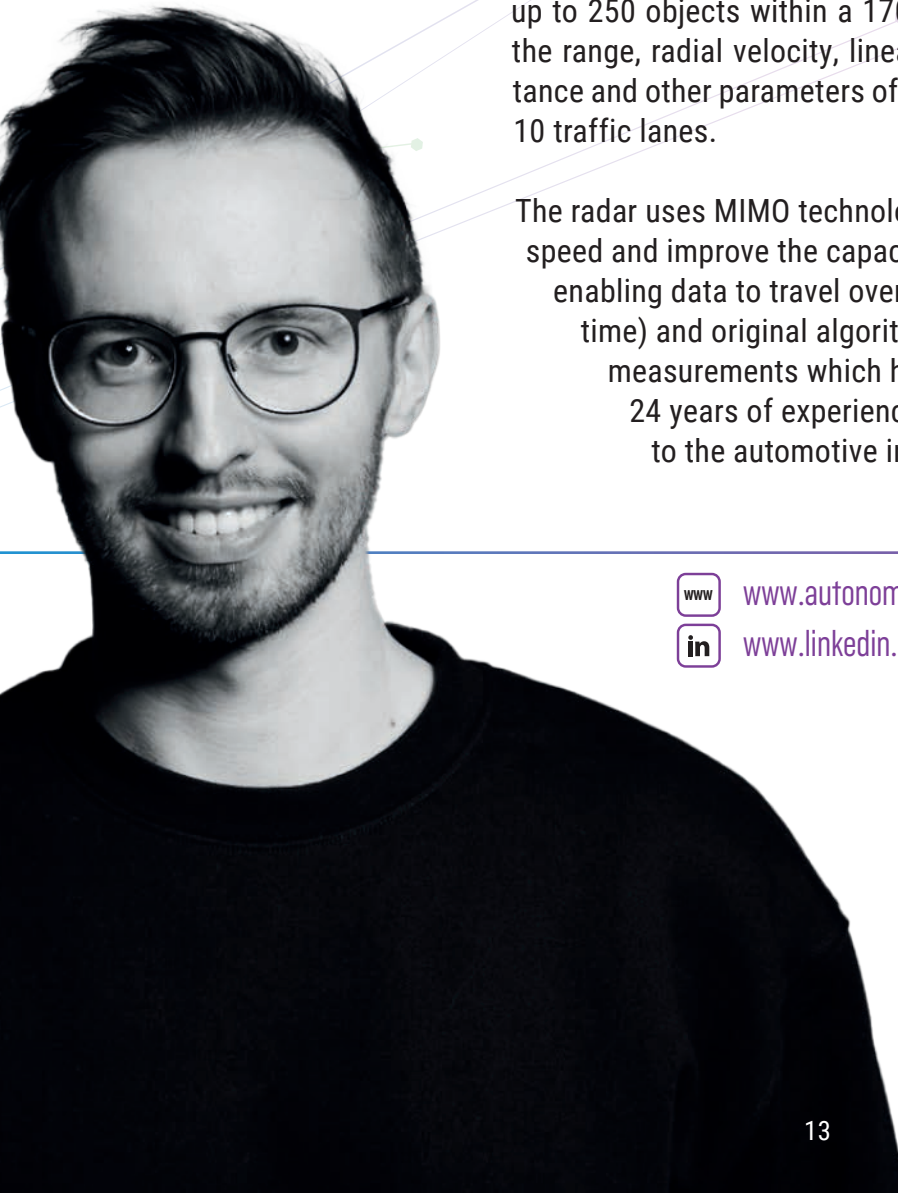
AutonomyNow™

ADAS System

Adas System from Autonomy Now is addressed to the manufacturers of city buses and coaches.

ADAS System by Autonomy Now ensures improvement of safety on board buses thanks to the use of next-generation cameras, radars, GPU units, and material solutions within one integrated system. The system monitors the surroundings of the vehicle and searches for hazardous situations, feeding the information to the driver and vehicle systems, improving the speed of reaction to the danger on the road.





Advanced radar is designed for commercial vehicles and boasts a wide angle of 100 degrees, which allows it to follow up to 250 objects within a 170 m radius. The radar measures the range, radial velocity, linear and horizontal angles, reflectance and other parameters of objects, which can occupy up to 10 traffic lanes.

The radar uses MIMO technology (used to optimize data speed and improve the capacity of radio transmissions by enabling data to travel over many signal paths at the same time) and original algorithms to achieve high-resolution measurements which have been developed thanks to 24 years of experience of ADAS systems dedicated to the automotive industry.



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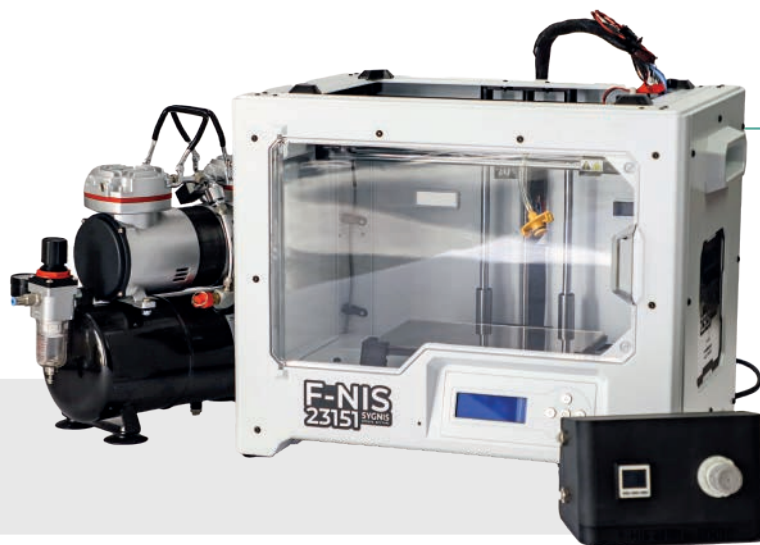


Distinction

SYGNIS

SPÓŁKA AKCYJNA

F-NIS 23151



F-NIS 23151 is the only copyrighted 3D printer which allows low-budget 3D printing utilizing liquid and semi-liquid materials for scientific and manufacturing purposes. The product is equipped with pneumatic extrusion system that allows 3D printing of one-component liquid and semi-liquid materials, such as silicone, ceramic paste, and resins. The device also features printout cross-linking using two UV wavelengths: 365 nm and 405 nm. The F-NIS 23151 printer is equipped with one print head and with a workspace of 220 mm x 140 mm x 110 mm. The work platform heats up to 120 C and the print head heats up to 60 C. The pressure spectrum reaches 400 kPa.

The 3D printing process can be handled via a USB link with your device or using an SD card. The container in the print head is available in three volume options: 10 ml, 30 ml, or 55ml. The device comes with an air compression and an original post-processing system.

F-NIS 23151 printer is a device that encourages the development of innovative solutions in electronics, robotics, energetics, and other industries by the testing new theoretical solutions in a cost-effective manner, targeted materials research, and solving challenges related to geometrical limitations for objects made using liquid and semi-liquid materials. Sygnis F-NIS 23151 printer is a device perfectly tailored to meet the needs of chemical and material labs and various workshops.



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Distinction



Chemo-resistant tank made using non-pressure technology. AmargTANK SafeSeamLess



The production of cylindrical tanks for storing water or corrosive, poisonous hazardous materials in the technology of non-pressure extrusion belt allows to limit production costs by 39%, limits CO2 emissions and material usage, expands the lifespan of the product by 76% and eliminates material strain.

Extrusion is a process of working with thermoplastic material, which has previously been processed mechanically. The material is made moldable through the use of appropriate devices and parameters, and it allows regulation of the structure and features of the product. In the case of a tank, you can manufacture a thicker wall of the container.



The innovative technology will allow completing projects, which were impossible by utilising traditional welded tanks. Moreover, it will allow the production of tanks, devices, or machines according to the investor's concept in an independent manufacturing process using intermediate goods such as pipes or cylinders.

The efforts to implement the technology began in 2019 with an aim to create a solution for storing dangerous substances of high reactivity. This solution also extends the lifespan of the product, which in turn, means lower costs and a lower carbon footprint.



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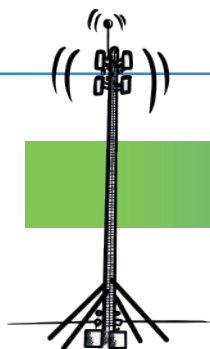
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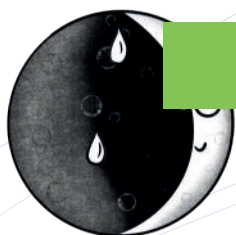
INNOVATIVE SCIENTIST CATEGORY





I Place – 20 000 PLN

Kamil Bechta, BEng PhD – For PhD dissertation: "Modeling of Directional Radio Links and The Accuracy of 5G Link Budget Estimation"



II Place – 15 000 PLN

Tomasz Gordon Wasilewski, BEng PhD – For PhD dissertation: "Phase change interface movement during thermal mining of icy regoliths in planetary environments"



III Place – 13 000 PLN

Michał Leško, BEng PhD – For PhD dissertation: "A method for operational optimization in a district heating system with simultaneous use of different solutions for thermal energy storage"

DISTINCTIONS:



Anna Laudańska Maj, PhD

For PhD dissertation:
"The influence of selected cosmetic materials on the internal structure and stability of stick lipsticks"



**Mateusz Płoszaj Mazurek, PhD,
Eng. of Architecture**

For PhD dissertation:
"Digital methods of supporting architectural design process – and the analysis of the carbon footprint of buildings"



dr Agnieszka Wencel, BEng PhD

For PhD dissertation:
"Analysis of the influence of different culture media on human liver cells for the bioartificial liver"

I place

Kamil Bechta, BEng PhD

Modeling of Directional Radio Links and The Accuracy of 5G Link Budget Estimation

Research Unit where the doctoral program was held:
the Military University of Technology in Warsaw.

Field of study: **Technical Informatics, telecommunication**

The main objective of this dissertation is the presentation of the accuracy of 5G radio link budget estimation from the perspective of joint modelling of the directional antenna beam pattern and angular spread phenomenon, due to the impact of this estimation on the efficiency of 5G and 6G network planning and optimization. Defining energetic balance is necessary to design a cellular radio network - the location and number of base stations, the height of antennas, direction of radiation. While in the case of previous cellular generations it was enough to rely

on nominal scale characteristics, in the case of 5G, which uses a new kind of antenna (featuring beamforming and multiple-input and multiple-output technology), it s necessary to evaluate a characteristic scale. It requires taking into the account landscape and other obstacles and features. The dissertation also presents an internationally patented solution to optimize an effective antenna gain. The research carried out by Kamil Bechta, PhD, helps establish an effective antenna characteristic based on its nominal characteristic and the features of its propagation environment



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II place

Tomasz Gordon Wasilewski, BEng PhD

Phase Change Interface Movement During Thermal Ice Mining from Regoliths in Planetary Conditions

Research unit where the doctoral program was held:
Space Research Centre PAS.

Field of Study: **Exact and Natural Sciences – Geophysics**

Extraterrestrial resources of ice are one of the most important space resources which can be used in the future. Their potential is included in many roadmaps for space exploration, such as ESA Space Resources Strategy or Artemis NASA Programme. Apart from the scientific objectives for the search for ice, which focus on listing volatile substances and their evolution in the Solar System, the main potential of the ice resources lies in its acquisition, development, and usage. Mining for ice resources will free the explorative potential of humankind to its maximum capacity - allowing the



refuelling of spaceships and granting access to resources so that space missions become independent from deliveries from the Earth.

The first usage of water from space will forever alter our perception of humans in space.

The dissertation focuses on addressing one of the key scientific gaps - understanding the flow of heat and mass in the process of thermal mining, its performance, and, above all, the performance of phase interface (or sublimation front, meaning the movement from solid state directly into gas omitting liquid state) in planetary conditions. The dissertation provides first-ever calculations of water extraction during operations on Mars and Moon and lists the main challenges of thermal mining.

The dissertation also shows the process of capturing water vapour and the potential redeposition of water over time. What is more, the paper presents simple tools to explore the economic and technical analysis of the production of water on Mars and the Moon. The dissertation suggests that there are plenty of places and bodies in the Solar System, which are currently considered to be “dry”, but actually can provide us with volatile resources.

 www.linkedin.com/in/gordonwasilewski/

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III place

Michał Leško, BEng PhD

A method for operational optimization in a district heating system with simultaneous use of different solutions for thermal energy storage.

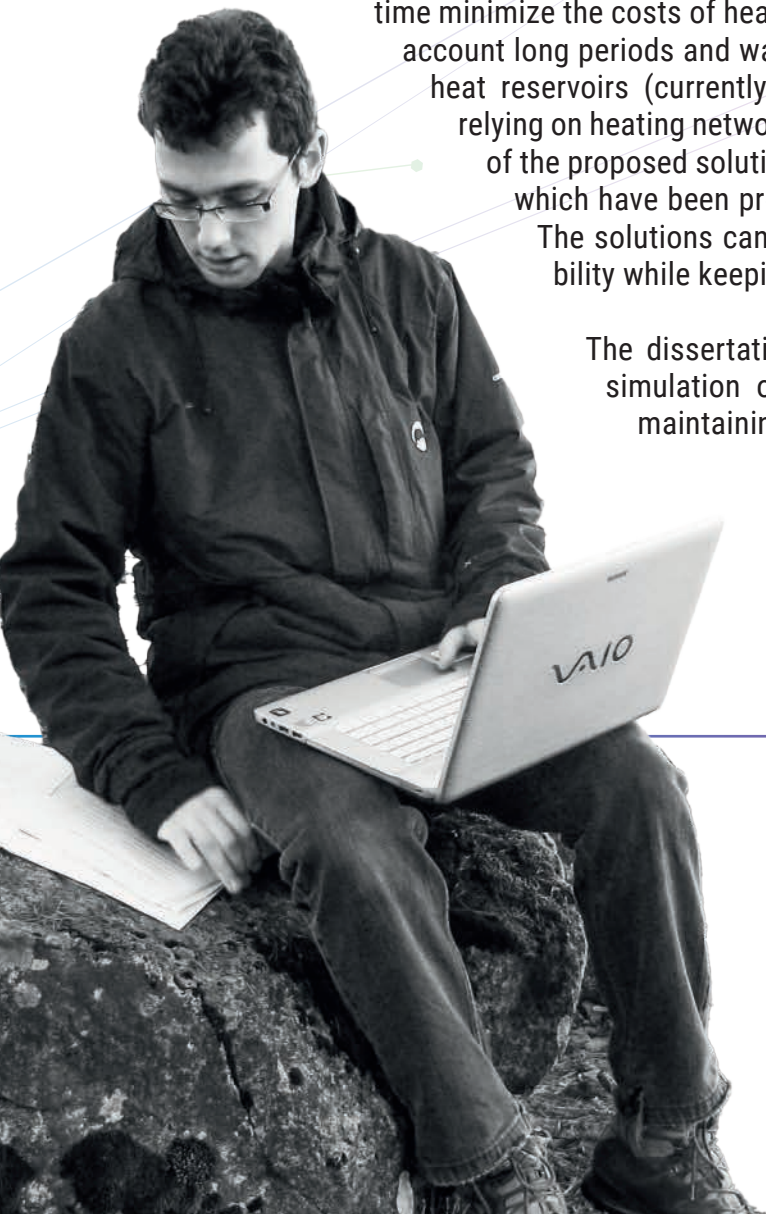
Research unit where the doctoral program was held:

**Thermal Technology Institute, Warsaw University of Technology;
Faculty of Power and Aeronautical Engineering.**

Field of Study: **Power Engineering**

Access to heating and reducing heating costs for city residents in the context of global fuel issues and concerns for the environment is one of the main challenges for modern energetics. The key role in this process is assigned to heating systems, which can be a source of cheaper energy, which is also safer for the environment than individual heat sources. The dissertation explored how heating systems can be optimized, with a focus on different methods of heat accumulation. A method of optimization based on solving sequences of mixed integer linear programming has been proposed and tested.

Optimization of the work of the heating system, especially if it is powered by a heat and power plant, is a difficult and complex task. The challenges of providing members of the society with heating include dynamic changes in the energy market, the necessity to introduce renewable energy sources, increased difficulties with fuel deliveries, and fluctuations in energy prices.



Finding a global optimum, which would address all needs, and at the same time minimize the costs of heating for the customers, requires taking into account long periods and ways of accumulating heat - using dedicated heat reservoirs (currently hot water reservoirs with stratification), relying on heating network inertia and building heating inertia. Each of the proposed solutions has its advantages and disadvantages, which have been presented and discussed in the dissertation. The solutions can be combined to achieve the biggest flexibility while keeping costs low.

The dissertation proposes a solution which allows the simulation of the work of the heating system while maintaining satisfactory precision and time of calculations. The solution has been successfully implemented and tested using real data from one of the heating systems.

 www.linkedin.com/in/michał-leśko-bb0120136

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Distinction

Anna Ludańska-Maj, PhD

The influence of selected cosmetic materials on the internal structure and stability of stick lipsticks.

Research unit where the doctoral program was held: **Warsaw University of Technology.**

Field of study: **Chemical Engineering**

Make-up constitutes the biggest group of stick cosmetics. Current trends, which aim to focus on protecting the environment, enforce new solutions to limit the use of plastic. Many well-known brands introduce skincare in stick products, introducing face and body lotions. Creating stick skincare is a challenging process. It is difficult to combine desired features when it comes to applying cosmetics with the product's stability and structure. The main components of stick cosmetics are waxes and oils. Waxes play a key role, as they give the product its form and qualities.

Based on her research, Anna Ludańska-Maj, PhD, named ingredients which prevent changes to the surface of the stick. Using them in the amount of the 2%, the surface of the sticks remained smooth and shiny throughout the lifespan of the product.





These additives are easily accessible and are often used as emulsifiers in the food or cosmetics industries. Not all emulsifiers are suitable for this purpose - in order to stabilize lipstick the substance has to have certain features. The tail (lipophilic fragment) should have a suitable length - C (18), but it is the head (hydrophilic fragment) that is crucial. It should be the right size, with donors and acceptors of hydrogen bonds. These additives participate in the creation of a crystal matrix, bonding with waxes used in lipsticks. Wax matrix with additives is more consistent, ties other ingredients better and is more resistant to temperature changes and is stable over time.

This solution will allow new stick products to be designed more quickly. It also ensures increased stability throughout the lifespan of the product, which will improve quality of the cosmetics and increased client satisfaction.

Distinction

Mateusz Płoszaj-Mazurek, PhD, Eng. of Architecture

Digital methods of supporting architectural design process – and the analysis of the carbon footprint of buildings

Research unit where the doctoral program was held:
Faculty of Architecture, Technical University of Warsaw.

Field of study: **Architecture and Town Planning**

How can AI help architects solve the problem of global warming? Research conducted by Płoszaj-Mazurek, PhD, concerns the use of artificial intelligence to support the early stages of design in order to analyze the carbon footprint (calculate all emissions) for a selected building. The method is based on machine learning and can be used to analyse the carbon footprint (i.e all emissions) of a building.

Płoszaj-Mazurek, PhD, devised a program based on machine learning that can foresee the carbon footprint of a building without performing calculations or simulations. This process allows architects to evaluate a building's carbon footprint in the early stages of the project - when the designer might not know all



details about the construction. Simultaneously, at these early stages of the project, decisions which influence the carbon footprint of a building are made. These decisions include its form, proportions, size, or location. The change of these features is often impossible in the later stages of the project - when a full carbon footprint analysis can be carried out.

The building industry, also decisions made by architects, are responsible for almost 40% of carbon gas emissions worldwide, thus playing a significant part in climate change. The dissertation explores how modern tools based on AI can support the design process. Apart from the main area of interest - reducing carbon footprint - the dissertation explores design issues such as optimization, illumination and energy expenses, and how algorithms can support decisions made by architects.



www.researchgate.net/profile/Mateusz-Ploszaj-Mazurek



www.facebook.com/themazurek



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Distinction

Agnieszka Wencel, BEng PhD

Analysis of the influence of different culture media on human liver cells for the bioartificial liver

Research unit where the doctoral program was carried out:

Institute of Biocybernetics and Biomedical Engineering

Field of Study: **Engineering and Technical Sciences**

The dissertation aims to establish methods of human liver cell cultivation that will increase their metabolic capacities and slow down the process of cell dedifferentiation in vitro. Agnieszka Wencel, PhD, combines interdisciplinary knowledge and skills in biotechnology, genetic engineering and biomedical engineering in the field of development of bioartificial liver, which aims to replace and support liver-specific functions.

Experiments and trials show innovative approaches to the preparation of functional biologic materials for bioartificial organs. According to Agnieszka Wencel, PhD, the most significant result of her research into methods of cultivation of liver cells, which can influence the development of biomedical engineering, is the introduction of new cultivation media - fibroblasts overproducing HGF (hepatocyte growth factor), and determining the cause of the problem with the cultivation of isolated hepatocytes using maceration method. Maceration is the process of extraction of certain elements from a material using a solvent, such as water.



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