



DEEP TECH 2M

BOOK OF ABSTRACTS

DEEP TECH OPEN SCIENCE DAY 2024

1ST DEEP TECH OPEN SCIENCE DAY CONFERENCE
APRIL 5, 2024, KRAGUJEVAC, SERBIA



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Editors: Fatima Živić, Ana Kaplarević-Mališić,

Nenad Grujović, Boban Stojanović

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Preface

FIRST DEEP TECH OPEN SCIENCE DAY CONFERENCE 2024 has been designed as the Science Fair - forum and exhibition of research results in all areas of science and innovation. Deep Tech brings together different fields of science that provoke major changes in the world today, such as:

- Advanced Materials and Manufacturing
- Aerospace
- Artificial Intelligence and Machine Learning
- Biotechnology
- Blockchain
- Web 3.0
- Electronics
- Photonics
- Quantum Computing
- Robotics
- Semiconductors (Microchips)
- Sustainable Green Energy and Clean Technologies

The conference presented an opportunity to gather young researchers and renowned scientists. The conference aimed to bring together young and senior researchers for networking, brainstorming, and promotion of science to scholars, students, prospective PhDs and young people and offers students the opportunity to experience the practices of science and engineering.

Deep Tech Open Science Day Conference 2024, in the form of the exhibition fair, was held on April 5, at Faculty of Engineering, University of Kragujevac. The Conference was opened by the vice-rector of University of Kragujevac, Vladimir Rankovic, dean of the Faculty of Engineering, Prof. Dr. Slobodan Savić, dean of the Faculty of Science, Prof. Dr. Marija Stanić, the State Secretary, Ministry of Science, Technological Development and Innovation, Prof. Dr. Miroslav Trajanović, CEO of MIND – Milanović Industries Group, Darko Djorić, the coordinator of the Innovation Incubator of University of Kragujevac, Nemanja Jovičić and Conference General Chair, Prof. Dr. Fatima Živić, Faculty of Engineering, University of Kragujevac.

Conference Organizing Committee, Prof. Dr. Fatima Živić and Prof. Dr. Nenad Grujović, from Faculty of Engineering, Prof. Dr. Boban Stojanović and Prof. Dr. Ana Kaplarević-Mališić, from Faculty of Science, University of Kragujevac, delivered the talks related to the Conference background:

- What is Deep Tech?
- Additive Technologies and Innovations
- Spinoff companies – the path from the research to market
- Why do we need market validation of research thesis?

Panel discussion "STARTUPS: yes or no?" was held with panelists: Dr. Vesna Rašković Depalov, EEN Serbia – BINS, Novi Sad, Dr. Nevena Mihailović, founder of HerbaLab cosmetics, research associate at the Institute of Chemistry, Faculty of Science, University of Kragujevac and Nemanja Jovičić, coordinator of the Innovation Incubator of the University of Kragujevac who discussed the Research commercialization, Intellectual property

rights in multidisciplinary teams, Experiences of startup founders – what is the most challenging?, and How can the Innovation Incubator of the University of Kragujevac help in founding the startup.

More than 90 research groups presented their works as physical exhibits, posters and virtual presentations, including two high school student teams and several student teams, as well as more than ten companies that have joint research with University of Kragujevac. Different state-of-the-art scientific areas were presented. Conference had more than 500 visitors, including researchers, university students and PhDs, and high school students from three secondary schools, who have discussed scientific topics with researchers and made contacts for further collaborations.

Deep Tech Open Science Day Conference 2024 was jointly organized by the Faculty of Engineering and Faculty of Science, University of Kragujevac, as the first scientific Conference of such concept in Serbia, with scientific articles presented through exhibits, sample model, real systems and machine elements, virtual show and simulations, providing hands-on experience on science for young and prospective researchers. The objective of the Conference and training event was to promote and educate on Deep Tech and science to the HEI academics and non-academics, researchers, and young people, as well as to the companies and general public and to enable networking between the HEI innovation ecosystem stakeholders. Most participants were from the Faculty of Engineering and Faculty of Science, but there were also participants from the Faculty of Philology and Art, Faculty of Economics, Faculty of Medical Sciences, and Institute for Information Technologies from University of Kragujevac, as well as from companies that have joint research with University of Kragujevac, Serbia.

The Conference was very successful with participation of the large number of young people – young researchers and prospective researchers and PhD students. The Conference model of scientific research fair showed that such a new concept of scientific work presentation is very well accepted by the young people who actively participated during the whole time of the Conference. Special contribution to the Conference was participation of the “Lego musketeers” team of the high school students who won the 1st Prize at national championship, the 1st Prize in finals of the Lego league in Slovenia and won Engineering Excellence award 1st place at FLL Florida Sunshine Invitational world event on June 19 – 22, 2024 – First Lego League Florida Sunshine Invitational, USA.

Images from the Deep Tech Open Science Day Conference 2024 are given at
<http://deeptech2m.eu/index.php/2023/12/25/prvi-deeptech-otvoreni-dan-nauke/>

Kragujevac, 2024

Conference Chair
Prof. dr Fatima Živić

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PLENARY TALKS

What is Deep Tech?

dr Fatima Živić, Faculty of Engineering, University of Kragujevac, Serbia

Additive Technologies and Innovations

dr Nenad Grujović, Faculty of Engineering, University of Kragujevac, Serbia

Spinoff companies - The path from research to market

dr Boban Stojanović, Faculty of Science, University of Kragujevac, Serbia

Why do we need market validation of the research thesis?

dr Ana Kaplarević-Mališić, Faculty of Science, University of Kragujevac, Serbia

DeepTech vs ShallowTech

Terence Bowden, Dermot Brabazon, Dublin City University, Dublin, Ireland

Optimization of Gear Pair in Planetary Gearbox Using TOPSIS Method

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Abstract

The optimization process of the first gear pair in a planetary gearbox was conducted through the application of the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method. In this study, considered input parameters were the gear width, module, and material of the gears, while the considered outputs were factor of safety from pitting SH and factor of safety from tooth breakage SF , for implementing the TOPSIS method. Based on the selected input parameters using the design of experiments, the L18 matrix was created to obtain results for the output values. The results obtained from the TOPSIS method indicate that the optimal parameters of the first gear pair, in terms of the safety factors SH and SF , are a gear width of 20 mm, a module of 2.25 mm, and a material of gears 16MnCr5. Also, the results of this research indicated that a significant reduction in the mass of the planetary gear was achieved.

The use of the TOPSIS method in engineering, especially in planetary transmissions, is highly significant and beneficial to the industry. The aim of the TOPSIS method application is to improve the efficiency of planetary transmissions by reducing vibration, increasing component lifespan, and other. In addition, optimization can decrease production costs, particularly in the manufacturing processes of planetary transmissions. This involves selecting suitable materials, dimensions, mass, and manufacturing technology for the transmission. The TOPSIS method is also crucial for planetary transmissions designed for specific purposes and operating conditions as it helps in selecting the optimal combination of parameters to achieve maximum efficiency and reliability in those conditions.

In this study, the TOPSIS method was applied in order to optimize the first gear pair, which transmits the highest load and power and is crucial for the reliable operation of the system. It has an impact on all other elements of the transmission, including second gear pair, shafts, bearings, and other. To obtain optimal values in terms of dimensions, mass, and reliability, the first gear pair was carefully optimized. The application of the TOPSIS method showed favorable results, reducing the mass of the gear pair by 20% compared to the gear pair before optimization. This, in turn, led to the reduction of the entire planetary gearbox mass, contributing significantly to its improved performance.

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