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## ABSTRACTS

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### **Mechanical and tribological properties of the TiB<sub>2</sub> coating deposited by HiPIMS method**

(pages 79-83)

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**Keywords:** HiPIMS, TiB<sub>2</sub> coating, hardness, Young's modulus, coefficient of friction.

**Abstract:** In the article, the authors briefly describe the high power impulse magnetron sputtering (HiPIMS) method. This method is briefly characterized in the article. Authors researched the mechanical and tribological properties of the TiB<sub>2</sub> coating deposited by the HiPIMS method on a steel substrate on an industrial machine. They were measured: hardness 25 GPa, Young's modulus 240 GPa, adhesion HF1, thickness 4.1 μm and coefficient of friction 0.7.

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### **Case study of using KEPServerEX software as a connection tool between Tecnomatix Plant Simulation and a real device**

(pages 85-89)

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**Keywords:** KEPServerEX, Tecnomatix Plant Simulation, PLC, CNC, OPC UA.

**Abstract:** The article focuses on the processing of simulation models, covering their creation methods and exploring the possibilities of collaboration. The author utilized the Tecnomatix Plant Simulation program developed by Siemens to design a visual representation of a production line and provided a detailed description of the steps involved in its creation. To achieve the objectives of the thesis, the author employed KEPServerEX, a software solution enabling the connection and communication between the Tecnomatix Plant Simulation program and the Programmable Logic Controller (PLC). This integration allowed for the successful connection of a CNC device, establishing communication and collaboration with the Plant Simulation program. In summary, the thesis project employed the Tecnomatix Plant Simulation program to create a comprehensive visualization of a production line. The integration of KEPServerEX facilitated seamless communication between the simulation software and the PLC, enabling effective cooperation with a CNC device.

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## Photogrammetric 3D digitization of the human head

(pages 91-95)

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**Keywords:** photogrammetry, measurement, walk-around method, head digitization.

**Abstract:** The paper deals with the use of photogrammetry in the digitization of living objects, specifically it is focused on creating a 3D model of the human head by the walk-around method with the using 1 camera. The RealityCapture software (CapturingReality, Slovakia) was used to create the digital model, the output of which is a head model with a realistic texture with sufficient details. Using the GOM Suite 2019 software (Carl Zeiss, Germany), selected anthropometric measurements of the model were carried out before comparing them with those obtained using traditional measurement of a living subject, which we considered the reference. According to the results, the obtained head model contains sufficient details (face surface, texture). The results show that the values obtained from the 3D model differ from the reference values from 0.1 to 1.8 mm with average value 0.637 mm and standard deviation 0.471 mm. The differences between physical measurement and 3D model are lower than 2 mm. Photogrammetry is applicable for field of anthropometry, medicine, technical orthopedy and other, because the results of measurement do not differ significantly from the reference measurements.

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## Repeatability and reproducibility of hydrogel 3D bioprinting

(pages 97-101)

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**Keywords:** 3D bioprinting, biomaterial, printability, shape fidelity, extrudability.

**Abstract:** The study presents the basic terms of three-dimensional bioprinting and physical, chemical, and biological properties affecting the printability of hydrogel biomaterials. It deals with the principle of evaluating the quality of three-dimensional bioprinting. The goal was to design a procedural algorithm to analyze prints produced by extrusion 3D bioprinting critically. Forty-one cylindrical scaffolds were created experimentally from the same material and under varying printing parameters. The settings of the most plausible sample compared to the CAD design were used to 3D bioprint ten cylindrical samples. Analysis of measurement system (ASM) with three operators was used for evaluation. The results showed that the printability measurement system is conditionally suitable. At the same time, the methodology for evaluating the shape similarity of samples through macroscopic pore classification requires re-evaluation and further experiments.

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**Methodology of CAD design and CAM production  
of transtibial prosthetic sockets**

(pages 103-108)

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**Keywords:** prosthetic socket, transtibial socket, CAD/CAM, 3D scanning, Fused Deposition Modeling.

**Abstract:** The digitization of the design process of lower limb prosthetic sockets seems to be necessary. Using modern CAD procedures and CAM technologies, it is possible to produce functional, individual prosthetic aids that bring many benefits compared to commonly used methods. However, the disadvantage of using CAD/CAM procedures can be the input costs for production technology and software. The aim of this research is to propose a low-cost solution for individual transtibial socket design and production. Modern methods and technologies like 3D scanning, CAD design and additive manufacturing have been applied. As a result, a transtibial stump positive and custom socket design methodology is proposed. In conclusions a total value of a custom transtibial socket design and production was calculated.

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