ABSTRACTS

https://doi.org/10.22306/atec.v10i2.198 *Received: 02 Apr. 2024; Revised: 27 June 2024; Accepted: 29 June 2024*

The use of alginate in the cultivation of mesenchymal cells in biomedical engineering

(pages 45-49)

Darina Bacenkova
Faculty of Mechanical Engineering, Technical University of Kosice, Department of Biomedical Engineering and Measurement, Letná 1/9, 040 01 Košice, Slovak Republic, EU,
darina.bacenkova@tuke.sk (corresponding author)
Jana Demeterova
Faculty of Mechanical Engineering, Technical University of Kosice, Department of Biomedical Engineering and Measurement, Letná 1/9, 040 01 Košice, Slovak Republic, EU,
jana.demeterova@tuke.sk
Erik Dosedla
Department of Gynecology and Obstetrics, Faculty of Medicine, Pavol Jozef Šafarik Univerzity Hospital AGEL Košice-Šaca, Pavol Jozef Šafarik University in Košice, 04015 Košice-Šaca, Slovak Republic, EU,
erik.dosedla@nke.agel.sk
Petra Gasparova
Department of Gynecology and Obstetrics, Faculty of Medicine, Pavol Jozef Šafarik Univerzity Hospital AGEL Košice-Šaca, Pavol Jozef Šafarik University in Košice, 04015 Košice-Šaca, Slovak Republic, EU,
petra.gasparova01@nke.agel.sk
Marianna Trebunova
Faculty of Mechanical Engineering, Technical University of Kosice, Department of Biomedical Engineering and Measurement, Letná 1/9, 040 01 Košice, Slovak Republic, EU,
marianna.trebunova@tuke.sk

Keywords: alginate, stem cells, biomedical engineering.
Abstract: Stem cells are a specialized type of cells in a human or animal organism that have the ability to self-renew and differentiate into various types of cells in the body. They have great potential in medical research and therapies as they can be used to treat a variety of diseases, regenerate tissues and develop new therapeutic approaches. In the article, we describe the cultivation of stem cells with alginate, which is used in 3D cultivation. The biopolymer alginate is preferred in biomedical applications due to its excellent properties. Polysaccharide alginate is isolated from marine, brown algae and bacterial cultures of species, *Azotobacter* and *Pseudomonas* species. Alginate is soluble in water, which allows easy processing and application in the form of various hydrogels or matrices. We present the preparation of alginate gel in the form of beads in combination with multiplied stem cells under in vitro conditions. At the same time, we observed how a natural polymer, specifically alginate, which is used for cultivation, behaves towards cells and how it affects their proliferation and differentiation.

https://doi.org/10.22306/atec.v10i2.199 *Received: 05 Apr. 2024; Revised: 15 May 2024; Accepted: 27 June 2024*

Using neural networks to forecast the frequency of accidents on particular Polish road types

(pages 51-56)

Piotr Gorzelanczyk
Stanislaw Staszic University of Applied Sciences in Pila, Podchorazych 10 Street, 64-920 Pila, Poland, EU,
piotr.gorzelanczyk@ans.pila.pl ORCID 0000-0001-9662-400X (corresponding author)

ABSTRACTS

Miriam Garbarova
Faculty of Operation and Economics of Transport and Communications, University of Žilina, Univerzitná 8215/1, 010 26 Žilina, Slovak Republic, EU, miriam.garbarova@uniza.sk

Keywords: forecasting, road accident, road types, neural networks.
Abstract: Globally, the quantity of road accidents is steadily decreasing annually. Even if the epidemic has recently had an effect, this number is still quite high. Therefore, every attempt should be made to reduce this number. The purpose of this article is to forecast the number of accidents that will transpire on various kinds of roads in Poland. For this purpose, monthly data on the total number of traffic accidents in Poland broken down by type of road were examined. Based on police data, a forecast was created for the years 2022–2040. A few neural network models were used to predict the frequency of accidents in Poland. The results show that we should keep expecting a high degree of stability in terms of the quantity of traffic accidents. On the one hand, the construction of new highways and the increase in the number of cars on Polish roads have an effect on this. The number of random samples utilized in the processes of learning, testing, and validation affects the results. In the case of 70-15-15, the average projected number of accidents for 2022-2024 should be: motorway - 827, expressway - 1136, 2 one-way carriageway - 5451, single carriageway -3067 and 1 carriageway 2 directions - 28048, respectively. For 80-10-10, these values should be respectively: motorway - 1057, expressway - 1141, 2 one-way carriageway - 5486, single carriageway -2745 and 1 carriageway 2 directions - 28039. As you can see, the values are similar.

https://doi.org/10.22306/atec.v10i2.200 *Received: 06 Apr. 2024; Revised: 12 May 2024; Accepted: 29 May 2024*

Investigating the feasibility of energy harvesting from the third pedal in automotive systems using a mechanical motion rectifier: simulation-based study

(pages 57-64)

Mohammed Alaa Alwafaie
István Sályi Doctoral School of Mechanical Engineering Sciences, Egyetem út 1, 3515, Miskolc, Hungary, EU, alwafaie.mohammad.alaa@student.uni-miskolc.hu (corresponding author)
Bela Kovacs
István Sályi Doctoral School of Mechanical Engineering Sciences, Egyetem út 1, 3515, Miskolc, Hungary, EU, matmn@uni-miskolc.hu

Keywords: energy harvesting, mechanical motion rectifier, simulation, electrical power generation.
Abstract: Automotive vehicles provide opportunities for energy harvesting from the mechanical motion generated during driving. In this study, we propose a novel design for a mechanical motion rectifier (MMR) that can generate electrical power from the mechanical motion of the third pedal in manual transmission vehicles. Using simulation and design tools, we investigate the feasibility of this system and explore the potential benefits and challenges of implementing it in automotive vehicles. Our results show that the proposed MMR system can effectively convert the oscillatory motion of the third pedal into unidirectional motion, which can then be used to generate electrical power. We also demonstrate that the design and operating parameters of the MMR system significantly impact its efficiency and performance. Our findings provide insights into the design and optimization of MMR systems for energy harvesting in automotive vehicles and highlight the potential for this technology to contribute to sustainable energy solutions.

https://doi.org/10.22306/atec.v10i2.201 *Received: 09 May. 2024; Revised: 26 June 2024; Accepted: 28 June 2024*

Comparison of mechanical properties polyamide materials produced by different additive technologies

(pages 65-71)

ABSTRACTS

Miroslav Kohan
Technical University of Kosice, Faculty of Mechanical Engineering, Department of Biomedical Engineering and Measurement, Letna 1/9, 042 00 Kosice, Slovak Republic, EU, miroslav.kohan@tuke.sk (corresponding author)
Viktoria Rajtukova
Technical University of Kosice, Faculty of Mechanical Engineering, Department of Biomedical Engineering and Measurement, Letna 1/9, 042 00 Kosice, Slovak Republic, EU, viktoria.rajtukova@tuke.sk
Tomas Balint
Technical University of Kosice, Faculty of Mechanical Engineering, Department of Biomedical Engineering and Measurement, Letna 1/9, 042 00 Kosice, Slovak Republic, EU, tomas.balint@tuke.sk
Jozef Zivcak
Technical University of Kosice, Faculty of Mechanical Engineering, Department of Biomedical Engineering and Measurement, Letna 1/9, 042 00 Kosice, Slovak Republic, EU, jozef.zivcak@tuke.sk
Radovan Hudak
Technical University of Kosice, Faculty of Mechanical Engineering, Department of Biomedical Engineering and Measurement, Letna 1/9, 042 00 Kosice, Slovak Republic, EU, radovan.hudak@tuke.sk

Keywords: SLS Technology, MJF Technology, PA, mechanical properties, orientation.
Abstract: Additive technology provides several advantages compared to traditional production methods, such as creation of complex geometric shapes with less material consumption. However, the setting of the 3D printing process as well as the positioning of the printed object has an impact on the mechanical properties of the material used. The aim of this study was to compare the mechanical properties of polyamide (PA) material as well as the influence of the orientation of printed objects when using SLS and MJF technology. The SLS technology used the P 396 device (EOS, Germany). An HP Jet Fusion 5200 (HP, USA) was used for MJF technology. In both cases, PA was used to creating experimental samples for mechanical testing. The orientation of the printed samples was 0°, 45° and 90° to the base platform of the 3D printer. The results show by comparing SLS and MJF technologies highest mechanical properties for MJF technology when the position samples were at 90° to the basic platform of 3D printer. Conversely, the lowest mechanical properties were recorded for samples that were positioned at a 45° angle to the base platform of the 3D printer using SLS technology.

https://doi.org/10.22306/atec.v10i2.203 *Received: 12 June 2024; Revised: 21 June 2024; Accepted: 27 June 2024*

Development of a robotic handwriting assistant for children with movement disorder

(pages 73-79)

Ismael Breton
Université Laval, Department of Mechanical Engineering, 1065 Av. De la Médecine, Quebec City, QC, Canada, G1V 0A6, ismael.breton.1@ulaval.ca (corresponding author)
Alexandre Campeau-Lecours
Université Laval, Department of Mechanical Engineering, 1065 Av. De la Médecine, Quebec City, QC, Canada, G1V 0A6, alexandre.campeau-lecours@gmc.ulaval.ca

Keywords: mechatronics, developmental coordination disorder, assistive technologies, robotics, handwriting.
Abstract: Developmental coordination disorder (DCD) impairs motor skills in children, particularly handwriting, which is a significant part of school activities and personal development. Current robotic assistants often lack a fully physical interaction or tangible result, thereby limiting their effectiveness in coordination development similar to handwriting. To address this gap, a robotic assistant capable of physical input and output could enhance development. This paper presents the development of a robotic handwriting assistant to aid children with DCD. The prototype is a planar robot controlled via a joystick capable of covering an 8.5" by 11" paper sheet. The paper provides insight into the causal real-world context of the prototype's development and discusses the designs considerations, the conception and the control. It concludes with intial results and the future for the project.