

SCIENTIFIC CONFERENCE
OF DOCTORAL SCHOOLS

BOOK OF
ABSTRACT

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SCDS-UDJG 2024

The Twelfth Edition,
GALAȚI, 6th-7th of June 2024

UNIVERSITATEA „DUNĂREA DE JOS”
DIN GALAȚI

**“DUNĂREA DE JOS”
UNIVERSITY OF GALATI
DOCTORAL SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING**

**BOOK of ABSTRACTS
Scientific Conference
of Doctoral Schools**

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The Twelfth Edition

GALAȚI, 6th-7th of June 2024

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SECTIONS COMMITTEES

Section 1

ADVANCED RESEARCH IN MECHANICAL AND INDUSTRIAL ENGINEERING

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Section 2

ADVANCED INVESTIGATION METHODS IN ENVIRONMENT AND BIOHEALTH

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FOREWORD

The 12th edition of the Scientific Conference organized by the Doctoral Schools of “Dunărea de Jos” University of Galati (SCDS-UDJG) was held in Galati, on the 6th and 7th of June 2024.

More than forty attendees gathered at "Dunărea de Jos" University of Galati to discuss their doctoral research works in Mechanical and Industrial Engineering, Environment, and Biohealth, as well as their potential applications.

A major goal of this conference has been to bring young academic scientists, engineers, and industry researchers together to exchange and share their experiences and research results and discuss the practical challenges they have encountered and the adopted solutions.

We invite you to play an active role and be a part of this vibrant community. Your knowledge sharing will contribute to the ongoing improvement of practices and enhancement of doctoral student learning outcomes.

The dedication of the Section Committee members has led to the continued excellence and popularity of the 12th Edition of SCDS-UDJG. The preparations for this conference would not be possible without the assistance of many colleagues.

My thanks to the support and devotion of the chairs of Sections 1 and 2, and the members of the international programme committee of this event, enabling us all to benefit from the chance to meet again or for the first time.

We look forward to seeing all of you next year at the conference.

Professor Luminita Moraru, Director of the Doctoral School of Mechanical and Industrial Engineering

THURSDAY – 6th of June 2024

SECTION 1 (online)

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OP. 1.3 (10 ⁴⁰ -11 ⁰⁰)	<u>Andreea Mandru</u> , Liliana-Celia Rusu, Florin-Dimitrie Pacuraru	Scale Effects on Ship Hydrodynamics in Calm Water and Regular Head Wave Conditions
OP. 1.4 (11 ⁰⁰ -11 ²⁰)	<u>Răzvan Sebastian Crăciun</u> , Virgil Gabriel Teodor	Numerical Representation of Objects – Representation of 3D Bodies

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THURSDAY – 6th of June 2024

SECTION 2

ADVANCED INVESTIGATION METHODS IN ENVIRONMENT AND BIOHEALTH

ORAL PRESENTATIONS

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POSTER SESSION

FRIDAY – 7th of June 2024

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ADVANCED INVESTIGATION METHODS IN ENVIRONMENT AND BIOHEALTH

Chair: Simona Moldovanu

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PP.2.3 (9 ²⁰ -9 ³⁰)	<u>Marcel Daniel Popa</u> , Ira-Adeline Simionov, Ștefan Petrea, George Adrian Ifrim, Puiu-Lucian Georgescu, Cătălina Iticescu	The chemical profile of urban waste water from the city of Galați, in order to use it as growth medium for microalgae
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PP.2.5 (9 ⁴⁰ -9 ⁵⁰)	<u>Valentina Andreea Calmuc</u> , Madalina Călmuc, Maxim Arseni, Catalina Iticescu, Puiu-Lucian Georgescu	Detection of pharmaceuticals in fish species from the Danube River
PP.2.6 (9 ⁵⁰ -10 ⁰⁰)	<u>Madalina Calmuc</u> , Valentina Andreea Calmuc, Maxim Arseni, Adrian Roșu, Puiu-Lucian Georgescu, Catalina Iticescu	Assessment of the microplastics presence in the Lower Danube River water and sediment
PP.2.7 (10 ⁰⁰ -10 ¹⁰)	<u>Orhan Ibram</u> , Cristina Despina, Adrian Burada, Iasemin Suliman, Mihaela-Iuliana Tudor, Maria-Cătălina Țopa, Cătălina Iticescu, Lucian Puiu Georgescu	Assessment of aquatic ecosystems in urban and reconstructed zones of the Danube Delta biosphere reserve using physico-chemical parameters and benthic macroinvertebrates
PP.2.8 (10 ¹⁰ -10 ²⁰)	<u>Viorel Călinescu</u> , Cătălina Maria Țopa, Lucian P. Georgescu, Cătălina Iticescu	Optimization of routes based on artificial intelligence as an integrated part of the waste management system in Galati county
PP.2.9 (10 ²⁰ -10 ³⁰)	<u>Cristina (Paraschiv) Nedelcu</u> , Steluța Gosav, Mirela Praisler	Characterization of flavonoids: an explorative review

PLENARY INVITED SPEAKERS

Advancing Diabetic Retinopathy Detection: An Ensemble Deep Learning Approach for Enhanced Classification Accuracy

Sirisha Daggubati¹

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Abstract

Diabetic retinopathy (DR) is a leading cause of preventable blindness in diabetic patients, necessitating timely screening and grading of retinal images to mitigate vision loss. This paper presents a three-stage ensemble of deep convolutional neural network (CNN) models for accurate DR detection and grading using fundus images. Each input image is divided into two patches and processed through four pre-trained CNN models (Xception, ResNet-50, InceptionV3, Xception). In the first stage, shallow and dense layer features from these models are integrated to capture significant DR information.

In the second stage, an artificial neural network (ANN) classifier is trained using fused probability vectors from the two patches. The final stage combines the outputs of individual CNN models to produce the final decision, leveraging an ensemble technique. This multi-level deep learning approach, which merges detailed local patch features with the holistic context of the entire fundus image, achieves superior classification accuracy.

The proposed method was evaluated against three classification schemes using a dataset of 1890 APTOS images, demonstrating the highest accuracy with 94.3% classification accuracy via tenfold cross-validation. This underscores its effectiveness in DR grading. The study highlights the significant roles of both local and global features in DR classification, setting the stage for further advancements in automated DR screening. Future work will explore more sophisticated neural network architectures and detailed classification of proliferative DR (PDR) images, aiming for a comprehensive and precise automatic DR grading system.

Keywords: Diabetic retinopathy, Ensemble, Shallow and dense layer features, Pre-trained CNN models

Explainable AI for Engineering Applications

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The deployment of artificial intelligence (AI), Machine Learning, and deep learning-based solutions at all places have improved for businesses from a variety of sectors, such as automotive, electronics, and medical device manufacture, when compared to conventional, rules-based implementations. Today's AI is model-centric where the data is stable and the majority of development efforts are spent on refining the model. In a data-centric AI approach, the data serves as the primary object that is iteratively developed and made deployable. This means more time is invested in labeling, managing, slicing, supplementing, and curating the data, while the model itself is kept relatively more static. The adoption of a data-centric strategy has resulted in some advancement that potentially makes AI benefits available to most businesses. The data-centric AI focuses on comprehending, utilizing, and reaching conclusions from data. AI used to be heavily dependent on rules and heuristics before becoming data-centric. These could be helpful in some circumstances, but when used on fresh datasets, they frequently produced less-than-ideal outcomes or even errors. By adding machine learning and big data analytics tools, data-centric AI modifies this by enabling it to learn from data rather than depending on algorithms. It can therefore make wiser choices and deliver more precise outcomes. Additionally, it has the potential to be significantly more scalable than conventional AI methods. As datasets get bigger and more complicated, data-centric AI will probably become more and more significant in the future. This session mainly focuses on recent developments in the Explainability of Outcomes of AI models and justifies the outcomes with feature importance. The key objectives of this session include presenting a need for Explainable AI well equipped with coding and approaches, and methodologies to achieve accurate results by improving the feature selections. Explainability helps to handle challenges in improving the quality of data-centric models, challenges in datasets generation, synthetic datasets, analysis, and prediction algorithms in stochastic ways, etc.

Keywords: Explainable AI, data-centric AI, scalability

I. ORAL PRESENTATIONS

SECTION 1

ADVANCED RESEARCH IN MECHANICAL AND INDUSTRIAL ENGINEERING

OP.1.1

Constant wind analyses on eight floating wind turbines

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Abstract

The objective of this work is to analyze the responses of eight floating wind turbines. From this perspective, this paper will compare the response offset regarding the motions of the six degrees of freedom of the respective floating wind turbines. The applied forces these analyses consider mainly come from constant wind forces applied on the wind turbines' blades, as well as forces from waves and currents. Different values are considered and compared regarding the constant wind speeds, as well as the velocities of waves and currents. This research is ongoing, and some other aspects will also be considered. Figure 1 presents an illustration of one of the considered floating wind turbines.

Keywords: renewable energy, offshore wind, floating platforms, marine environment.

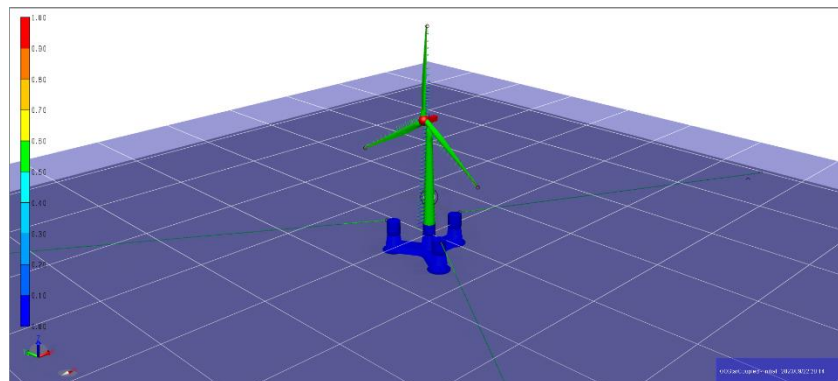


Figure 1. OOSTar semi-submersible floating wind turbine with 10 MW power capacity

OP.1.2

Global structural response of inland vessels under grounding loading scenarios

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Abstract

In the current study the authors investigate the global response of three typical river barges subjected to accidental loads under grounding scenarios. The main objective of the study is to analyze the local and global structural state of stresses and deformations following the accidental loads under fore grounding scenarios, using actual scanned data of the Danube riverbed around Galati inland navigation area. The study contains a careful analysis of the 3D scan of the riverbed to point out critical areas where grounding accidents could occur in navigation conditions. Three typical, open deck, river barges have been selected for the global structural evaluation, a 76 meters barge, 80 meters double ended barge and a 90 meters barge, covering the common dimensions of unpropelled commercial inland navigation vessels. The analyses performed provide information regarding the state of stresses and deformation before and after the accidental grounding loads and therefore the risks associated with these critical situations.

Keywords: Grounding analysis, riverbed bathymetry, 3D structural analysis.

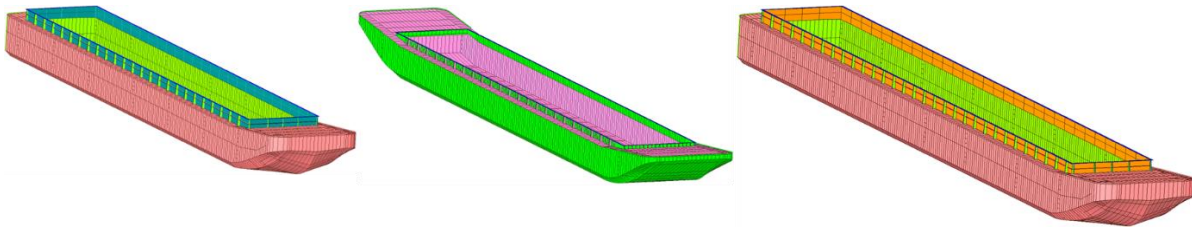


Figure 1. Barge 76 meters(left), Barge double ended 80 meters(centre), Barge 90 meters(right)

OP.1.3**Scale Effects on Ship Hydrodynamics in Calm Water and Regular Head Wave Conditions****Andreea Mandru^{a,*}, Liliana Rusu^b, Florin Pacuraru^a**

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Abstract

Accurately predicting the hydrodynamic performance of a ship at sea depends on a comprehensive understanding of scale effects, as the initial performance evaluation is based on scaled models. Investigating scale effects can increase the accuracy of the behavior prediction of a full-scale ship in its operational environment. The present study investigates the hydrodynamic performances of a container ship at both model and full-scale in calm water conditions and regular head waves. Numerical simulations using Fidelity Fine Marine software were performed to analyze the flow around the ship hull. The viscous flow solver utilizes the Reynolds-Averaged Navier-Stokes (RANS) equations with a finite volume approach for spatial discretization. The volume of fluid (VOF) method captures the free surface, while the $k-\omega$ SST model handles turbulence closure. In calm water conditions, the numerical simulations for the model were performed at six speeds corresponding to those previously analyzed during towing tank tests, for validation purposes. For the full-scale simulations, three speeds corresponding to the analyzed Froude numbers were chosen to investigate scale effects. Comparisons were made between the total resistance curves, free surface topology, pressure distribution in the aft region, and the axial velocity in the propeller plane. For regular head waves at the design speed, three wave lengths at three wave heights were investigated for both model and full-scale. To validate the results, the wave lengths and heights matched those used in the towing tank tests. Scale effects were evaluated by scaling the wave length and height for the full-scale case to be similar to the model conditions. Total resistance, wave added resistance, heave and pitch curves were compared, along with the wave topology, mass fraction distribution on the hull, and the axial velocity in the propeller plane. Verification and validation of the computed solutions were achieved through comparisons with publicly available experimental data.

Keywords: scale effects, RANS, VOF.

OP.1.4

Numerical Representation of Objects – Representation of 3D Bodies

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Abstract

We are familiar with everything necessary to create the image of a point or a line in digital environment, we can represent many points in 2D and in 3D. So that these sets of points projected in a design software can be transformed into somewhat suggestive images of solid objects, it is necessary to know the order in which certain points must be joined together by segments or curves, thus suggesting to the operator constructive surfaces. The information needed to build a body image is stored in a "database", having a very well-defined ordered structure of numbers and characters. The structure of the database strongly influences the speed of work, the required memory of the program, the flexibility of the program, as well as the ease of writing the program. This paper presents some common ways of organizing data to generate different types of simple representations in ascending order of complexity.

Keywords: through points, wireframe, the polygon network, curves and curved surfaces.

II. INVITED LECTURES

SECTION 2

ADVANCED INVESTIGATION METHODS IN ENVIRONMENT AND BIOHEALTH

IP.2.1

Classification methods for data, metadata, and images

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The presenting author: Simona Moldovanu

Abstract

Recently, various technologies related to artificial intelligence (AI) have become favorite techniques to classify metadata, data, and images. Neural networks (NN), machine learning (ML), and deep learning (DL) are the main AI tools. They can complete various specific tasks. When they work as a classifier, they can be used individually or in various combinations so that their cumulative decisions improve the performance of classification. AI tools often provide the best results when a tuning process is performed. AutoMLs tool selects the best ML with optimal hyperparameters from a set of ML models to dramatically improve the classification performance with the best time complexity. Convolutional neural networks (CNNs) are tuned similarly by integrating AutoMLs in the analysis of features extracted from different layers of CNN. Usually, any analysis based on DL approaches is carried out using widely available data sets, from publicly available resources. An important aspect of AI is transfer learning, consisting of CNN's pre-trained architectures tested with a large ImageNet database. GoogleNet, VGG16, VGG19, Resnet, LeNet, or AlexNet are software programs trained on the ImageNet database and used to classify and detect objects and scenes. The accuracy classification is affected by the GPU system, number of data points, number of images, number of epochs, batch sizes, or quality of the data. Data preparation is one of the most important steps in AI implementation and is also a time-consuming process.

Keyword: *Artificial Intelligence, machine learning, convolution neural networks*

SECTION 2

ADVANCED INVESTIGATION METHODS IN ENVIRONMENT AND BIOHEALTH

OP.2.1

Arsenic in the living environment and ecosystems of the Prut River

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The presenting author: Ciorba Petru

Abstract

Arsenic is an immunotoxin element that in living organisms, being a part of many important biochemical processes, interacts with different groups of proteins, lipids and in increased quantities affects oxidative processes. Being a toxic element, arsenic concentration is limited in drinking water and food products by Community Directives and national regulations. Arsenic compounds enter into the body of animals and humans in increased quantities from polluted air, especially in industrial areas, including thermal power plants, metallurgical, military, chemical, pharmaceutical plants, with drinking and mineral water, from grapes, fruits, marine products (fish, snails, algae), from medicines, pesticides and herbicides. The risk of arsenic accumulation is also increased in tobacco smokers. In the period 2020-2023, we investigated the dynamics of this element in the water, suspensions, sludges and some groups of aquatic organisms (macrophytes, zoobenthos, fish) from the Prut river ecosystems within the limits of the Republic of Moldova. Directly in the field, the water samples were filtered through membrane filters with a pore size of 0.45 µm, to separate the dissolved metals from solid suspensions. Under laboratory conditions, there were prepared the filters with suspensions, and a quantity of 0.1-0.3 g of sludge and biological material was subjected to digestion in the Berghof SPEEDWAVE digestion system. The determination of arsenic was carried out with inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) iCAP 6000. In the investigated period, in the waters of the Prut River, the content of As fluctuated within the limits of 0.40 - 7.29 µg/l, having an increasing trend during the years of investigation and showing a maximum in 2023. In suspensions, the As concentrations are lower than in water with an obvious tendency to increase along the river's course towards the lower sector, being maximum in Giurgiulesti. Among aquatic organisms, the maximum is recorded in clams. In the investigated fish, arsenic concentrations do not present a danger to the health of consumers, the maximum being recorded in the liver and skin of cyprinid fish and the minimum - in the muscles of the body. These concentrations are much lower compared to the concentrations of fish in the Cuciurgan cooling reservoir of the Moldovan Thermal Power Plant. The sources of pollution with arsenic compounds are various pesticides, herbicides, metallurgical enterprises and power plants using fossil coal and fuel oil. It should also be mentioned the pollution with pharmaceutical preparations that contain arsenic compounds.

Keywords: *Arsenic, ICP-OES, Prut river, Moldova*

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OP.2.2

Impact of the interaction of climate change, anthropogenic modification and the Jevons Rebound effect and paradox on water multi-connectivities in inland watercourses and its effects on carbon storage

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Abstract

This paper explores the multifaceted interactions between climate change, anthropogenic modifications, and the Jevons rebound effect within inland watercourses, examining their impact on water multi-connectivities and carbon storage. We analyze how rising global temperatures and human interventions disrupt water and carbon cycles in aquatic ecosystems. By applying systems theory, we offer a holistic view on how enhanced connectivity and continuity in river systems can mitigate adverse effects, emphasizing the critical role of maintaining watercourse integrity against anthropogenic disruptions. Notably, we examine the paradoxical increase in resource consumption due to greater efficiency, known as the Jevons rebound effect, within the context of water resource management. Our findings underline the necessity for integrated management strategies that consider both human and ecological dimensions to ensure sustainability. We highlight the use of advanced technologies and the importance of systemic research in understanding and managing the ecological impacts of climate change, ultimately suggesting pathways for mitigating and adapting to these changes in inland water environments.

Keywords: *climate change, anthropogenic impact, Danube Delta, Jevons Rebound Effect.*

OP.2.3

Artificial intelligence in lung cancer diagnosis: A comprehensive review

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Abstract

Lung cancer remains one of the most prevalent and deadly malignancies worldwide, posing significant challenges to early detection and treatment. In recent years, the emergence of artificial intelligence (AI) has revolutionized various aspects of healthcare, including the diagnosis and management of cancer. This paper provides a comprehensive overview of the current state-of-the-art AI techniques employed in the diagnosis of lung cancer. It explores the utilization of machine learning algorithms, deep learning models, and computer-aided detection systems to analyse medical imaging data, such as chest X-rays, computed tomography (CT) scans, and magnetic resonance imaging (MRI) scans. Additionally, the integration of AI with clinical data, genomic profiling, and biomarker analysis to enhance the accuracy and efficiency of lung cancer diagnosis is discussed. Furthermore, the challenges and opportunities associated with the implementation of AI-based diagnostic tools in clinical practice, including issues related to data quality, interpretability, and regulatory approval are discussed. By harnessing the power of AI, clinicians can achieve earlier detection, more accurate risk stratification, and personalized treatment strategies for patients with lung cancer, ultimately improving patient outcomes and reducing mortality rates.

Keywords: *lung cancer, deep learning, medical imaging.*

OP.2.4

Assessing the chemical potential of certain flavones based on DFT theory and molecular docking

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Abstract

In the pursuit of innovating cancer treatments, investigating natural compounds presents a promising pathway because of their varied molecular structures, distinctive biofunctionalities, and minimal adverse effects. Among them, flavonoids, renowned for their diverse pharmacological characteristics, emerge as powerful chemo-preventive agents that are regulating cell proliferation, managing cell cycle dynamics, and inhibiting oncogenic signaling pathways. The aim of this paper is to investigate the molecular interaction between two flavonoids and the PI3K α protein, by using Vibrational Energy Distribution Analysis, FT-IR, HOMO-LUMO analysis, DFT calculations and MEP mapping.

Keywords: *flavonoids, molecular descriptors, molecular structure, MEP*

OP.2.5

Testing classification performance of deep learning models: a comparative study based on image edges

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Abstract

Nowadays, deep learning (DL) is becoming more and more significant. This field includes speech recognition, self-driving cars, medicine, cancer detection, face recognition, and predictive forecasting. It has already had a significant influence. Convolutional Neural Networks (CNN) use multiple layers, such as, convolutional, pooling, and fully connected layers. In terms of their numbers and arrangements, CNN became more or less efficient. In this paper, AlexNet, GoogLeNet, VGG (Visual Geometry Group), ResNet (Residual Network), Deep Neural Network (DNN) and the proposed CNN were used. All CNNs were trained on three classes: apples, peaches, and oranges. The data set was downloaded from Kaggle and collected with the Flicker tool. The best classification accuracy of 0.912 was obtained by the proposed CNN. As is known, the main features that CNN learns well are edges. In this context, all images were processed with the first-order filter Sobel, after projection of the edges on the vertical and horizontal axes, and the density of the edges with the deviation standard, skewness, and kurtosis were computed. The violin graph values clustered the statistical values around the median, and as a result, the density of the edges computed from apples is higher, indicating that the true positive samples from confusion matrices are close to the number of tested images that contain apples.

Keywords: *Convolutional Neural Networks, classifications accuracy, filter Sobel, violin graph*

OP.2.6

Classification of microorganism using convolutional neural network and H2O AutoML

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Abstract

The study advances microorganism image classification through a hybrid approach that integrates a Convolutional Neural Network (CNN), modified from the VGG19 architecture, with an ensemble model powered by H2O AutoML. Employing data augmentation and advanced feature extraction, the approach enhances performance on a dataset encapsulating a broad spectrum of microorganism classes. The CNN model shows marked accuracy enhancements in complex classes, as depicted by the confusion matrix. Concurrently, the AutoML ensemble delivers comparable accuracy, notably in classes where CNNs typically struggle. This research highlights the complementary strengths of deep learning and AutoML, demonstrating their collective impact in achieving high-precision microorganism recognition. Such advancements promise to significantly benefit bioinformatics and diagnostic applications, addressing the complexity of multi-class image classification tasks. The results indicate a successful combination of CNN and AutoML methodologies, setting a benchmark in automated microorganism classification. The results showcase a successful integration of CNN and AutoML methods, contributing to advancements in microorganism classification techniques.

Keywords: *CNN, AutoML, microorganism, VGG19*

OP.2.7**A new approach for extracting image features using octave band analysis**

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Abstract

The distribution of the gray levels in breast ultrasound images is a feature strongly correlated with the texture analysis or is a useful tool for shape-based object recognition in images. A new algorithm using the principles of the octave band analysis is proposed to extract the most relevant feature images in the breast ultrasound images (BUSI) to discriminate the specificity between benign lesions and malignant breast cancer. BUSI contains benign and malignant breast cancer images along with their ground truth. The goal is to devise a simple model capable of accurately predicting the meaningful features for breast lesion classification. The first step is concerned with grayscale images resizing to a 254 x 254 resolution. Then, based on the centroid position determined for each ground truth image, six bands crossed the image in well-establishing positions, i.e., three vertical and three horizontal. These bands have 2-, 4- and 8-pixel bandwidth. The bands in the image are placed at intervals of 10 pixels, the position of the centroid being the reference of their placement. Then, a novel approach based on octave band analysis will divide each selected band into subbands following the rule of “octave band in base 2”. The results consist of twelve subbands with size of 2, 2², 2³, 2⁴, 2⁵, 2⁶, 2⁵, 2⁴, 2³, 2², 2 pixels. Each subband has distinct grayscale characteristics, in different portions of the breast lesion (according to its spatial position and its rank in subband succession) and allows the computation of various features. The statistical analysis of the pixels’ distribution associated with each subband is employed. The average, standard deviation, skewness and kurtosis statistical features were computed. These statistics are influenced by the bands’ and subbands’ positions.

Keywords: *breast lesion; octave band analysis; breast US images; statistical features*

II. POSTERS

SECTION 1

ADVANCED RESEARCH IN MECHANICAL AND INDUSTRIAL ENGINEERING

PP.1.1

Studies on the Replacement of Traditional Materials Used in the Construction of Sports Boats and Yachts up to 70 Meters with Al-Fabric-Al Type Materials

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Abstract

In the context of growing concerns for sustainability and performance in the construction of sports boats and yachts up to 70 meters in length, recent studies have explored the possibility of replacing traditional materials with Al-fabric-Al composite structures. These composite materials not only offer superior mechanical properties and corrosion resistance but also have the capability to store electrical energy, making them highly versatile for nautical applications. Moreover, substituting traditional materials with these composites advances sustainability objectives and contributes to pollution reduction, thereby reducing the carbon footprint of the vessels. This paper presents an analysis of the advantages and challenges associated with the use of Al-Fabric-Al composite materials in boat and yacht construction. It examines the properties of these materials, manufacturing methods, as well as their impact on vessel performance, energy efficiency, and energy storage capacity. Additionally, potential applications and benefits of these materials in the modern maritime industry are discussed, highlighting the importance of innovation and adaptation to advanced technologies in the shipbuilding sector.

Keywords: Al-Fabric-Al composites, Energy storage, Marine construction, Advanced technology.

PP.1.2

Analysis of the Mechanical Properties of the Ceramic-based Restorative Materials using Instrumented Indentation Technique

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Abstract

Resin-based composites are used worldwide in restorative dentistry, mainly because of their esthetic quality and good physical properties, and efforts are continuously made to improve the clinical and mechanical behavior of the restorative materials. Recently, Admira Fusion emerged as novel ceramic-based restorative material, combining fillers and resin matrix based purely on silicon oxide. Comparing to all conventional restorative composites, this novel restorative composite exhibits very low polymerization shrinkage and shrinkage stress and excellent biocompatibility.

During the chewing process the restorative materials are exposed to mechanical loads and abrasive and erosive wear. Moreover, tooth cusps and hard foods cyclically indent the restoration. Therefore, understanding the indentation behavior is essential for using Admira Fusion in restorative dentistry. This paper aims to investigate the mechanical properties of the Admira Fusion restorative composite using instrumented indentation technique. In particular, the influence of the indentation depth on the indentation response of the restorative composite is investigated. Micro-indentation tests are performed in a load-controlled mode at different indentation depths to extract the mechanical properties such as indentation hardness and elastic modulus.

Keywords: water quality, statistical methods, Danube River.

PP.1.3

Considerations on the 3D printing of organic structures

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Abstract

Additive manufacturing (AM) has made it possible to produce complex structures composed of cellular networks. Cellular structures are composed of an interconnected network of plates, struts, or small unitary cells, thus acquiring multiple benefits, some of them unique, notably: high resilience/weight ratio, excellent energy absorption and the reduction of material requirements. Compared to conventional manufacturing processes, additive manufacturing is capable of yielding geometries in almost all types of shapes, with small cellular structures within, by adding the material layer after layer, retrieving the necessary geometry directly from the digital data file. The selection of a topology for the cellular networks is of utmost importance for the maximization of the structure's value and unique properties, necessary for achieving the target application. This paper presents a classification and illustration of cellular structures inspired by and synthesized from biomimetics.

Keywords: Additive Manufacturing, Cellular Structures, Biomimetics.

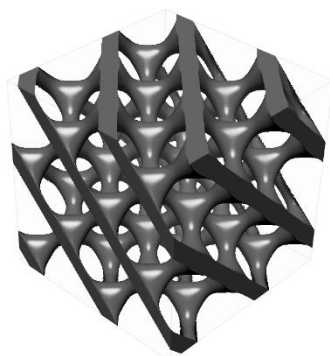


Figure 1 “Schwarz D” structural cellular network

PP.1.4

A more comprehensive picture of Renewable energies in the Black Sea nowadays

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Abstract

This paper aims to evaluate the renewable energy potential in the Black Sea. The promotion of renewable energies will reduce emissions consistently and will be an important contributor to energy security supply and sustainable growth. Long-term sustainable development of European offshore renewable energy requires knowledge of the best places for installing offshore. Every country has their own natural resources which can be diverse. According to the different geological, economic and sociological conditions, the green energy transition would be different for any country. A very good starting point is the fact that the economic potential of renewable energy sources in our country is considerable.

The main objective of this research is to provide a more comprehensive picture concerning renewable energy sources in the marine environment and to present the most important exploitation methods based on existing research. The evaluation of efficiency and capacity to maximize it is also an objective of this research.

Keywords: renewable energy, marine environment potential, Black Sea.

PP.1.5

The influence of Y_2O_3 nanoparticles on the polymeric membrane properties

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Abstract

In recent years, membrane manufacturing technology (respectively, membrane separation) is widespread due to its notable advantages: ease of operation, ability to save energy, compact size and its economic viability; among which, several of their applications can be found for the purification of natural gas, hemodialysis (in medicine), but especially for the filtration of contaminated water. Mixing nanomaterials in the membrane matrix by the phase inversion method is one of the most researched techniques in obtaining composite polymer membranes.

In this work, flux and permeability results were obtained for membranes with a concentration of 21% PES (polyethersulfone), respectively 21% PES with Y_2O_3 nanoparticles, at a thickness of 250 micrometers.

Keywords: membrane, polymer, nanoparticles, water filtration.

PP.1.6

Investigating Roll Parameters for a 3D-Printed Ship Model

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Abstract

Roll motion, characterized by the swaying motion of a vessel about its longitudinal axis, creates significant challenges to safety, comfort, and operational efficiency, particularly in smaller vessels. By incorporating control surfaces (actuated fins) into the hull, the magnitude of this motion can be diminished. To assess their effectiveness, it is initially imperative to ascertain specific parameters for the bare hull.

This study explores the initial phase of investigating roll behavior in a 3D-printed ship model. To achieve this, parameters like the center of gravity (ZG) and moment of inertia (J_{xx}) were established. A custom-built experimental stand was designed and used for accurate determination of these parameters. Inclining tests were conducted to identify the ZG, a value used for the future Computational Fluid Dynamics (CFD) studies for roll decay. J_{xx} was also determined to calculate the added mass (M_{44}), which helps to understand the ship's roll dynamics.

Keywords: added mass, roll, ZG.



PP.1.7

Assessment of repairing method of degraded wind turbine blades

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Abstract

In case of wind turbines, due to blade length, the rotational speed may reach high values. If in the environment of the turbine placement there dust or sand particles, on the blade occur superficial degradations due to the abrasive wear processes. During the stormy weather these processes are amplified, even the turbine is in protective stop mode. The tests were performed on samples extracted from an industrial produced blade. The structure of the material is composed by several layers, with a rigid one, as cover and an elastic one in the middle. The tests, performed on a rig with air driven sand particles, shown that the protective surface layer is the most resistant. If this layer is degraded, the beneath ones are quickly destroyed. In order to avoid this, on the cover layer a self-adhesive protective film was applied. The compared tests shown that the blade surface's resistance is augmented, leading to a higher abrasive resistance.

Keywords: wind turbine blades, abrasive degradation, repairing method.



Figure 1. Comparison between protected and unprotected blade surface

PP.1.8

Artificial neural network based method for the optimization of brake materials**George Bălăsoiu^{a,*}, Valentin Amorțilă^a, Costel Humelnicu^a**^a "Dunărea de Jos" University of Galati, Faculty of Engineering, 47 Domnească Street, RO-800008, Galati, Romania

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*Corresponding author: valentin.amortila@ugal.ro**Abstract**

The paper presents a method for optimization of the recipes for brake materials. Usually, these recipes are confidential, each industrial producer using own compositions. Even the materials used are known, the precise percentages are unrevealed. Based on the properties of artificial neural networks (ANN) to optimize the input values for desired values of the output, the paper presents a method for obtaining better brake materials. Starting with the composition of several industrial brake pads, obtained by EDX analyse, an ANN based model was built and trained. The model allowed the identification of the inputs' influences and, also, a new recipe, with the same materials but with optimized percentages following the goals to obtain the highest friction coefficient and lowest wear rate values.

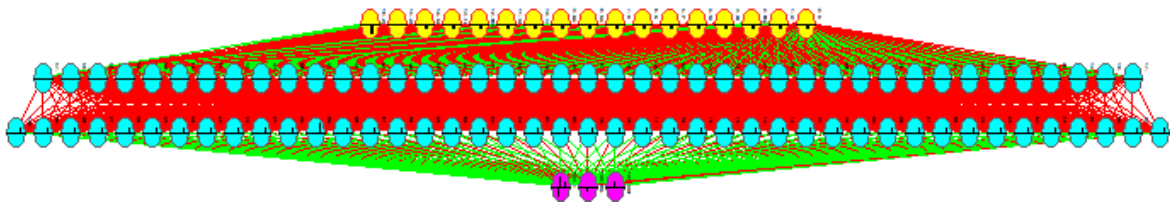
Keywords: brake materials, ANN modelling, optimization.

Figure 1. Artificial neural network model

PP.1.9

Investigation on impact degradation of wind turbine blades

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Abstract

The paper presents the results obtained during the investigation on how the blades of wind turbines are affected by the impact with hard solid particles. Taking into account that, due to blade length, the rotational speed may reach high values, the impact with ice drops, little rocks etc. can lead to serious damages of blade surface. If there is also a high wind speed, the resulting kinetic energy value exceed the blade cover resistance limits and degradation occurs. The tests were performed on samples extracted from a real blade, with a layered structure, using a ball shaped impactor, with different values of the kinetic energy. The results shown that the sandwich structure of the blade is highly affected at the superficial layer level. This layer is breakable and, because the layers beneath are elastic, can be easily broken.

Keywords: wind turbine blades, impact degradation.

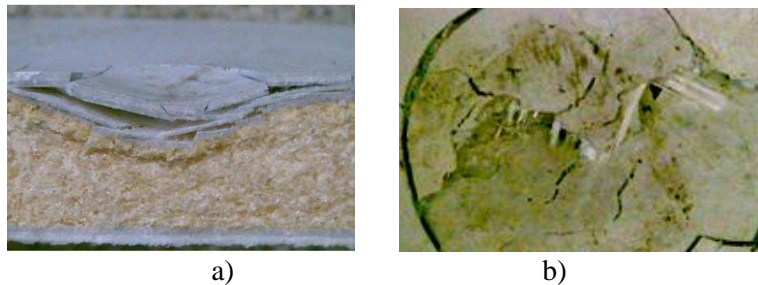


Figure 1. Impact degradation: a) cross-section view; b) front view

PP.1.10

Using a genetic algorithm to enhance the safety of the Black Sea naval operations

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Abstract

The Black Sea is a sea basin that tends to bear maritime accidents due to its features related to shipping or naval activities in an environment influenced by anthropogenic activities and physical features. However, the environmental sustainability of naval operations is not just a factor but a crucial imperative during the planning process and execution. Even though the Black Sea is a semi-enclosed basin, economic and naval activities are dynamic, and threats like significant wind and sea heights or sea-deriving mines are often present. Based on a mathematical model, we have analyzed the possibility of increasing the capability of conducting and ensuring the safety of naval operations in the Black Sea basin. Based on a semi-fictitious scenario, the paper appraised the opportunity of using a genetic algorithm to support the crew in enhancing the operation's safety and reducing its cost with a lower environmental burden, underlining the urgent need for sustainable solutions.

Keywords: Black Sea, routing, genetic algorithm, safety, model.

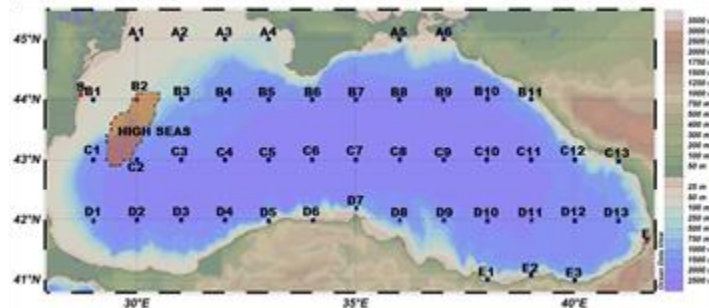


Figure 1. Interest area with vertexes and high seas polygon

PP.1.11

UHMWPE in Ballistic Protection

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Abstract

This paper presents a review of the applications of UHMWPE in ballistic protection and the result of ballistic test on plates made of Endumax®, which is a trade mark of Teijin Aramid VB. The plate is obtained by a particular technology of pressing under constant temperature and the test was made using a projectile of 400 m/s and there were investigated the failure mechanisms of the plate.

Keywords: UHMWPE, ballistic protection, Endumax®, failure mechanisms.



Figure 1. Cross section in a plate of 100 layers of Endumax®

PP.1.12

A Survey of Some Water Characteristics for Prut River

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Abstract

This paper presents the evolution of some characteristics for water in the Prut River, for 5 years. There will be presented and analyzed water temperature.

Surveying and analyzing river water characteristics is crucial for several reasons: water quality monitoring, ecosystem health and security, management of resources, flood and drought management, climate change impact and community engagement.

Prut river has particular evolutions of its characteristics due to its geographical position and specific climate. The dependences of analyzed characteristics mainly on seasons reflect that human activities is not yet dominant in modifying these parameters.

The water sampling station is located near the city of Cahul, an emerging city as concerning economic, academic and social life in Republic of Moldova.

Figure 1 presents the evolution of river water temperature for the interval 2018-2022 and it varies with the seasons, local and continental geography and climate. It can impact the aquatic ecosystem, affecting the growth of aquatic plants and the behavior of aquatic organisms.

Keywords: water quality, Prut river, temperature, time interval.

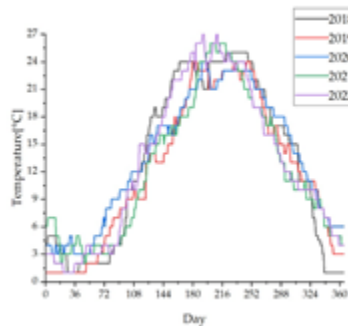


Figure 1. Temperature evolution for Prut river, for 5 years (2018-2022)

PP.1.13

Modeling the three-point bending test for a stratified composite

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Abstract

The present study investigates the simulation of the structural performance of an advanced glass fiber-reinforced composite material in a three-point bending test. The laminated composite is subjected to a comprehensive investigation method based on the finite element method (FEM), in ANSYS software, Explicit Dynamics module, to evaluate its behavior under a particular flexural loading. Through the use of a rigorous isothermal simulation and numerical modeling framework, the interaction between the composite matrix and glass fibers is analyzed, by taking into account the mechanical properties of the composite layer as homogenous and isotropic. FEM simulations provide a well-defined understanding of the stress and strain distributions in the laminate under various bending loadings, pointing out typical stress concentration areas and possible locations of structure failure. Results obtained from FEM simulations lead to a better knowledge concerning the mechanical characteristics of the composite material and its behavior under bending conditions, therefore offering important insights for the design optimization of innovative composites. Furthermore, it may be used in the subsequent development of composite materials and manufacturing processes to optimize their quality, performance, reliability, and durability in a wide range of applications.

Keywords: composite material, glass fiber, three-point bending, finite element method, stress distribution, strain distribution, mechanical properties.

SECTION 2

ADVANCED INVESTIGATION METHODS IN ENVIRONMENT AND BIOHEALTH

P.2.1

The use of interpolation polynomials in the approximation of functions: comparative study

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Abstract

In this study we present three methods of approximating functions using interpolation polynomials. In engineering there are many situations where it is necessary to approximate the value of a function at a certain point knowing that a finite set of experimental data or the expression of the respective function is complex. We use methods specific to numerical analysis such as Lagrange interpolation, the method of dividing differences and Neville's methods. In this sense, we choose a function f defined on an interval $[a,b]$, and the purpose of this note is the construction of a function that approximates the function f at a predetermined value. The expression of the approximation functions will be calculated and we will evaluate the error recorded in the approximation specific to each method.

Keywords: *Polynomial approximation, Lagrange interpolating polynomial, Newton's method, Neville's method.*

P.2.2

Quantification of health risk associated with radon exposure

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Abstract

Radon represents the most important source of natural radiation of the population, whose harmful effect has a cumulative character and synergism with other risk factors such as tobacco consumption. In the Republic of Moldova, based on a study measuring the radon concentration in a sample of 1,100 homes using RADTRAK2 passive detectors, the population exposure doses to radon were calculated. Following the statistical processing of the collected data, the following results were obtained for a uniform distribution of the data, thus maximum values of 1160 Bq/m³ are recorded for the Center area, 1260 Bq/m³ for the North area and 950 Bq/m³ for the area north. South. The average concentration of radon in the indoor air is 211.67 Bq/m³; 240.55 Bq/m³ and 285.57 Bq/m³ for the Center, North and South. The share of homes that exceeded the reference level of radon (300 Bq/m³) constituted 25.3% for the Center area, 31.06 – from North and 38.58% – from South. Studying the dependence of radon concentration on the abiotic factors of the environment of the existence of a close correlation link with the formation of the cluster with the large Euclidean distance, and the linkage distance constituting 4250 for the radon concentration and the maximum air temperature and the soil surface temperature. At the same time, the case-control study on the influence of radon on the occurrence of lung cancer revealed the following concentrations for the experimental group, the average value of the concentration of radon in the indoor air of 194.3 Bq/m³, and the maximum value 857.2 Bq/m³, value. average recorded for the control lot is 165.2 Bq/m³, and the maximum value 922.2 Bq/m³. The fundamental study through cluster analyzes of the "radon × smoking" interaction influence detected significant interactions between the researched factors manifesting trigger capabilities on the onset of lung cancer.

Keywords: *Radon, health risk, statistical methods, Moldova*

P.2.3

The chemical profile of urban waste water from the city of Galați, in order to use it as growth medium for microalgae

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Abstract

Urban waste water can have applicability in the cultivation of microalgae, as a growth medium. There are numerous studies that highlight the efficiency of microalgae to treat urban waste water and store important quantities of compounds for use in various industries. For this purpose, it is necessary to know the chemical profile of the water, to ensure a favorable environment for the development of microalgae.

The urban waste water of the city of Galați was considered in this experiment. Water samples were taken for a week and the chemical compounds with influence on the growth of microalgae were analyzed: TN, NO₃⁻, N-NO₃⁻, NO₂⁻, N-NO₂⁻, NH₄⁺, N-NH₄⁺, TP, PO₄³⁻, P-PO₄³⁻, SO₄²⁻, Cl⁻. The obtained values were compared with those from other scientific works that addressed the same subject, in order to compare and evaluate the potential of urban waste water to be used in the growth of microalgae.

Keywords: *water quality, waste water, water chemistry.*

P.2.4

Vegetal layer restoration of contaminated sites from petroleum industry using sewage sludge

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Abstract

Soil is the non-renewable natural resource, extremely valuable for maintaining life on Earth. Large areas of soil are often polluted with petroleum products as a result of various human activities. In this case, it is necessary to remediate the contaminated soils from the oil industry and return them to the natural and economic circuit. In addition, large quantities of sewage sludge are daily generated by sewage treatment plants. The purpose of this study was to use the soil subjected to a bioremediation experiment with sewage sludge as support for the development of a new vegetal layer in order to restore the natural balance. Grass was sown in the land treated with sewage to monitor its development. Through microbiological analysis, we observed that both soil and sewage sludge have a high content of bacteria that could play an important role in seed germination. And through the Infrared spectroscopy (IR) analysis, a decrease in the concentrations of petroleum hydrocarbons was observed in the soil treated with dehydrated sludge. By means of the combined methods SEM-EDX (Scanning Electron Microscopy – Energy Dispersive X-ray), we have analyzed the soil microstructure and the distribution of chemical elements to highlight the plants evolution. The present study considers the soil regeneration in areas contaminated with petroleum products and opens new perspectives for the use of sewage sludge in ecological reconstruction.

Keywords: *soil, sewage sludge, bioremediation, vegetal layer.*

P.2.5

Detection of pharmaceuticals in fish species from the Danube River

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Abstract

Fish are considered biological indicators that can characterize the ecological status of an aquatic ecosystem. This is due to their ability to accumulate pollutants that are in the water and sediments in their organs. Pharmaceutical residuals are an important class of pollutants that can accumulate in fish tissues. The main aim of the present study was to detect the presence of some classes of pharmaceuticals in different fish species collected from the Lower Danube River Basin. The fish species analyzed in this study were: *Alosa immaculata*, *Carassius gibelio*, *Perca fluviatilis*, *Hypophthalmichthys molitrix*, *Abramis brama* and *Vimba vimba*. The results obtained using liquid chromatography coupled with high resolution mass spectrometry indicated that the pharmaceutical substances most frequently detected in the analyzed fish tissues are caffeine and carbamazepine.

Keywords: *fish species, Danube River, pharmaceutical residuals*

P.2.6

Assessment of the microplastics presence in the lower Danube River water and sediment

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Abstract

Microplastics are classified as emerging pollutants with toxic potential on aquatic biota. Although most research focuses on microplastics (MPs) in the surface layer of freshwater, they are present in both the water column and sediments. In this paper, the occurrence of MPs in the Lower Danube water (surface layer and 7 m depth) and sediment was studied. MPs were collected from water using pump-type sampling equipment and the sediment was sampled using a Van Veen grab. The identification of MPs was performed using Spotlight 400 FT-IR Imaging System, producer Perkin Elmer. According to the results obtained, it was observed that the most commonly detected polymers were polyethylene and polypropylene. Regarding morphological classification, the majority of the MPs were fragments, films, and fibers.

Keywords: *column water, sediment, Lower Danube, microplastic, micro-FTIR.*

P.2.7

Assessment of aquatic ecosystems in urban and reconstructed zones of the Danube Delta biosphere reserve using physico-chemical parameters and benthic macroinvertebrates

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Abstract

According to the European Pollutant Release and Transfer Register (maintained by the European Environment Agency, which provides comprehensive data on major industrial installations in Europe, the BFD "hosts" over 3,000 large-scale industrial installations. Of these, the energy sector, mineral and chemical industries, metal processing and waste management sectors stand out as having the highest concentration of installations. In particular, more than 100 of these industrial installations discharge wastewater directly into surface waters, releasing a mixture of organic materials, nutrients and hazardous substances. This study assesses the ecological status of aquatic ecosystems within the Danube Delta Biosphere Reserve by analysing main physico-chemical, nutrients indicators and macroinvertebrate from urban-influenced aquatic systems segments of the Danube River and two ecologically reconstructed areas. The data was collected between spring and summer of 2023 and used to assess the quality of both biotic and abiotic components. Results of nutrient analysis showed low concentrations of ammonia nitrogen (mean < 0.5 mg/L), nitrite nitrogen (mean < 0.1 mg/L) and nitrate nitrogen (mean < 1 mg/L), which were well within the class I water quality limits. Total nitrogen concentrations (averaging about 1.5 mg/L), reflecting both organic and inorganic nitrogen, indicated a good ecological status. Phosphate concentrations (mean < 0.1 mg/L) were found to be in excellent ecological status. Heavy metal contaminants were generally within acceptable limits, although lead levels exceeded Class I standards at some monitoring stations. Benthic macroinvertebrate composition was also examined. Dominant taxa included chironomids (26% of total abundance), amphipods (25%), oligochaetes (19%) and gastropods (19%). Statistical analysis showed no significant spatial differences in macroinvertebrate abundance between the Danube River and the reconstruction zones. The highest macroinvertebrate abundance, dominated by oligochaetes (50%), was found in the Galati urban zone.

Keywords: *aquatic ecosystems, urbanization and ecological reconstruction, Danube Delta*

P.2.8

Optimization of routes based on artificial intelligence as an integrated part of the waste management system in Galati county

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Abstract

In the face of increasing challenges related to the efficient management of waste, route optimization becomes a main and at the same time essential element of the entire waste management system in Galați County. The main purpose of this study is to determine how artificial intelligence (AI) is integrated into the optimization of waste management routes in Galați County, bringing a new perspective on efficiency and sustainability in waste management. By using advanced route planning algorithms and relevant data, optimal waste collection routes can be identified, reducing operational costs and environmental impact. Integrating AI technology into this process not only optimizes the use of resources, but also helps reduce carbon emissions and pollution associated with waste transportation and improves quality of life. According to the study, the implementation of artificial intelligence in the optimization of routes for waste management represents an important step towards an efficient and sustainable management of resources in Galati County.

Keywords: *economic, A.I., environment, waste management system, algorithms, optimization, sustainable.*

P.2.9

Characterization of flavonoids: An explorative review

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Abstract

As pollution levels rise, individuals become more susceptible to illness. Flavonoids represent a significant dietary resource for humans. Due to their diverse molecular structures, unique bifunctionalities, minimal side effects and rich pharmacological profiles, flavonoids became valuable targets for drug design. The objective of this paper is to conduct a systematic review of the various types of flavonoids and their physico-chemical properties.

Keywords: *flavonoids, molecular descriptors, molecular structure*