

1st International Conference on Engineering, Technology, and Applied Science Innovations

ICETASI 2025

2025, October, 1-3, Amaliada, Greece

Book of Abstracts



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ΠΟΛΙΤΙΣΤΙΚΟΣ ΣΥΛΛΟΓΟΣ

EOS
CULTURAL ASSOCIATION

ICETASI 2025

1st International Conference on Engineering, Technology, and Applied Science Innovations

Organized by the EOS Association and the Department of Environment of the Ionian University, under the aegis of the Region of Western Greece.

Book of Abstracts



EOS Association

Editors: Gerasimos Pylarinos, Christos P. Antonopoulos, George Syrrokostas, Panteleimon Apostolopoulos, Stratos David

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1st International Conference on Engineering, Technology and Applied Science Innovations
(ICETASI 2025)



**International
Conference on Engineering, Technology
and Applied Science Innovations**

**1-3
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ICETASI 2025

Amaliada, October 1-3, 2025



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(ICETASI 2025)**



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Preface from the editors

The **International Conference on Engineering, Technology and Applied Science Innovations (ICETASI)** is a premier gathering of professionals and academics dedicated to advancing knowledge and fostering innovation. The scope of the conference is to provide an academic-meets-industry forum on recent developments and innovations, while giving a local aspect on the recent advancements and major issues concerning the region.

All presented works were reviewed by members of the scientific committee (all academic scholars or industry-occupied Ph.D holders) and volunteer reviewers with at least an M.Sc. degree in relevant fields. Selected full conference papers will be published by the International Journal **Annals of Computer Science and Information Systems (ACSIS)**. The current volume contains all the abstracts of the submitted and presented works, either in the form of a speech/presentation or a poster.

During the conference, new engineering trends were explored, focusing on the environmental, social, and individual impact of modern society and technology, and ways to mitigate arising issues related to water and waste management, overtourism, artificial intelligence, education, laws and regulations, new materials, green technology, and quality of life.

ICETASI 2025 was the first academic conference organized by EOS Association, a non-profit organization established in Northwest Ileia, Greece, and we hope that many more will follow. It was held on October 1-3, 2025 at the Grand Elis Hotel, Amaliada, Greece. The principal objectives of EOS Association are the promotion of culture, education, and science through the organization of various actions and events.





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The organizing committee would like to thank the our sponsors, the volunteers Fatah Bakour, Mayur Rele, Nikos Bravos, Panagiota Bravou, Wasim Saikh, and Md. Imran Nazir for their contribution and the management of the Grand Elis Hotel for the hospitality.



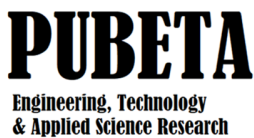
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Region of Western Greece



Construction of Water Supply Network from the Chavarovrysis Reservoir to the Geraki Reservoir

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Abstract—The Municipality of Ilida implemented the project "Construction of Water Supply Network from the Chavarovrysis Reservoir to the Geraki Reservoir" with a total budget of 4.310.483,87 €. The project is financed by the Operational Program "Western Greece", Priority Axis 2 "Environmental Protection – Transition to an environmentally friendly economy", co-financed by the European Regional Development Fund (ERDF), under the action "Modernization of water supply networks operations". The project concerns the construction of a water supply network with a total length of 10.979 m, starting from the Chavarovrysis reservoir placed at an elevation level of +172.00 m and ending at the Geraki reservoir at an elevation level of +94.80 m. The existing water supply network, which originates from the Kakotari springs, has a total length of about 100 km, has been in operation since 1994, and covers territories located within the administrative borders of the Municipalities of Ilida, Andravida–Kyllini, and Pineios. The pipelines of this network initially presented serious problems, mainly due to construction defects, but after specialized maintenance and intervention works, the operation of the network improved significantly. Nowadays, during high water consumption periods (mainly in summer), many regions of the abovementioned Municipalities face serious problems of water shortage. These problems are caused by two main factors: a) The irrigation needs in combination with the seasonal reduction of the springs' flow during the summer period; b) Possible inadequacy of the diameters of the existing pipelines to meet the increased water consumption needs during peak periods. The design of the new network is planned for a 40-year period. The water supply network is constructed of steel ductile pipes of nominal diameters DN700mm and DN350mm. More specifically, the DN700mm pipe section was used for a total length of 3.029 m, from the Chavarovrysis reservoir to the branching chamber in the Chavari area (future extension of network to the Municipality of Pineios and Municipality of Andravida - Kyllini), whereas the DN350mm pipe section was placed for 7.950 m ending at the Geraki reservoir. The ductile steel pipes have an interior coating made of concrete, and their outer surface is coated with over 99.99% metallic zinc (200 g/m²) as the finishing layer. The positive Zinc ions (Zn²⁺) react with the negative soil ions and can repair any damage caused to the coating of the pipe during the backfilling of the pipe trench. In combination with the epoxy painting, it ensures the protection of the pipe material against corrosion.

Keywords—irrigation; Ilida municipality; Geraki water reservoir



Shut-off valves (PN16atm) for network isolation

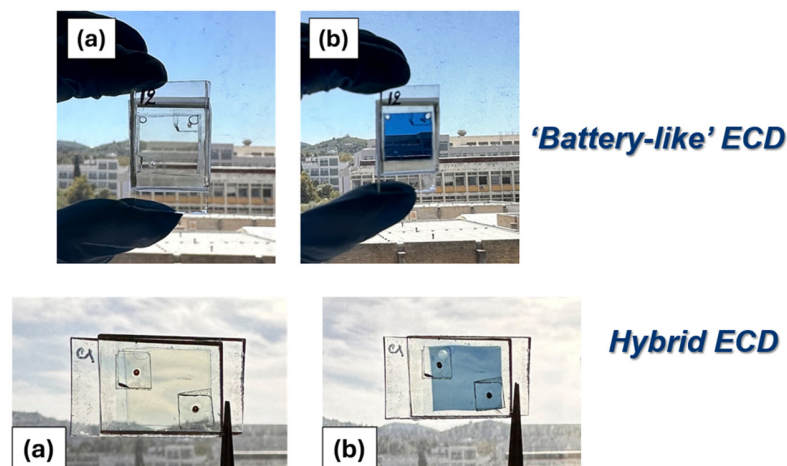
A Comparative Study of "Battery-like" and Hybrid Electrochromic Devices for Dynamic Solar Control

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Abstract—The optical and the electrochemical properties of tungsten oxide electrochromic (EC) layers, prepared by evaporation and by electrodeposition, were evaluated in this study. A higher charge capacity, along with a higher value of the bias potential for complete bleaching, was observed in the first case, attributed to differences in their morphology, while minor differences appeared in their transparencies in the visible part of the solar spectrum. Battery-like and hybrid EC devices were prepared, and a coloration efficiency up to $52 \text{ cm}^2/\text{C}$ was obtained, depending on the type of device and the deposition method of the EC layer. An improved open circuit memory was achieved by battery-like devices, irrespective of the deposition method of the EC layer, but hybrid EC devices exhibited lower operating voltages and bleaching under short circuit conditions, making them promising devices for improving the energy efficiency of buildings.

Keywords—tungsten oxide; evaporation; electrodeposition; cobalt redox electrolyte; battery-like electrochromic devices; hybrid electrochromic device





Fabrication of Aesthetic and Sustainable Photo-Rechargeable Storage Devices Based on Perovskite–Supercapacitor Architectures

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Abstract—The rapid proliferation of autonomous electronic systems and Internet of Things (IoT) devices demands reliable and sustainable power solutions beyond conventional batteries, which are constrained by environmental impact, finite lifespans, and limited charging cycles. The PHOTO-GREEN project introduces an integrated approach by monolithically combining Perovskite Solar Cells (PSCs) with carbon-based Supercapacitors (SCs) into aesthetically customizable photo-rechargeable storage devices. Laser-reduced Graphene Oxide (LrGO) films served as transparent conductive electrodes, achieving low sheet resistance and good optical transmittance without the need for plasma treatment or high-temperature annealing ($>100\text{ }^{\circ}\text{C}$), thereby ensuring compatibility with flexible and transparent device architectures. Furthermore, femtosecond and nanosecond laser ablation allowed for precise layer patterning and aesthetic design without compromising power efficiency. Optimized perovskite formulations with various band gaps were synthesized to tune the absorption profile. Inverted PSCs fabricated with these materials achieved a peak efficiency of 5% following optimization of the interfacial layers. Optical modeling and spectroscopic analysis confirmed the robustness of the laser-induced modifications and guided device optimization. The demonstrated monolithic PSC-SC devices provide a scalable, cost-effective, and environmentally sustainable strategy for powering next-generation self-sufficient electronics, bridging the gap between high-performance photovoltaics and sustainable storage technologies.

Keywords—Perovskite, photo-rechargeable storage devices; customization

Acknowledgment: This work was supported by: Greece 2.0 NATIONAL RECOVERY AND RESILIENCE PLAN "BASIC RESEARCH FINANCING" (Horizontal support for all Sciences) ID 16618 – Subproject 1 (MIS: 5163923)

Project Title: Aesthetic PHOTO-rechargeable storage cell Fabricated via precision laser manufacturing, Project Acronym: PHOTO-GREEN, Project ID: 014791





NutriSense: A Decision Support System for Precision Fertigation in Soil and Soilless Vegetable Production

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Abstract—NutriSense is an advanced Decision Support System (DSS) developed to optimize fertigation strategies in vegetable crop production, both in soil-based and soilless systems. Its core purpose is to help growers accurately tailor nutrient supply to plant needs, thereby improving efficiency and reducing environmental losses. The system incorporates validated models and algorithms that consider plant species, growth stage, climatic variables, and cultivation method to maintain balanced nutrient levels in the root zone. NutriSense comprises two main modules: SOIL NutriSense for field cultivation and SOILLESS NutriSense for hydroponic systems. The soil-based module provides fertigation recommendations based on data from soil and irrigation water analyses, helping to ensure nutrient availability while preventing leaching and over-fertilization. As crop development progresses and new analysis data are obtained, fertilizer recommendations can be dynamically adjusted. The soilless module focuses on the composition of nutrient solutions, considering both the mineral profile of the irrigation water and system-specific parameters. A key application of this module is in closed-loop hydroponic systems, where the drainage solution (DS) is reused. NutriSense can refine the nutrient supply by adjusting inputs based on the chemical analysis of the recycled DS. To address sodium accumulation—a major challenge in closed-loop setups due to rising salinity and electrical conductivity (EC)—the DSS employs specific algorithms and modeling techniques. Additionally, the system is compatible with ion-selective electrodes (ISEs) that monitor nutrient levels in real time, allowing for automated and highly precise fertigation adjustments. In summary, NutriSense represents a notable innovation in the field of precision agriculture. It offers a holistic, adaptive approach to nutrient management, enhancing crop performance while promoting resource efficiency and environmental sustainability in both soil-grown and hydroponically cultivated vegetables.

Keywords—hydroponics; soilless culture; soil crops; plant nutrition



Invited Speech

Artificial Intelligence and Moodle: Challenges and Opportunities for Smart Learning

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Abstract—A Learning Management Systems (LMS) is a software specialized in delivering and organizing educational content. Such systems often remain static and fail to provide engaging or interactive learning experiences, potentially reducing student engagement and teaching effectiveness. Integrating Artificial Intelligence (AI) into LMS platforms has the potential to address these drawbacks by offering dynamic, real-time, and personalized support. Moodle, a leading LMS, is continuously incorporating AI technologies to improve learning through adaptation, personalization, and more efficient assessment. This study explores the opportunities and challenges of integrating AI within Moodle, emphasizing its role in fostering a more intelligent and interactive learning environment.

Keywords—Moodle; smart learning



Study of Environmentally Friendly Advanced Materials as Electrodes for the Denitrification of Drinking Water Using Electrochemical Methods

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Abstract—The main problem in treating contaminated water through electrochemical methods is the efficiency of electrodes, the reduction of electrode mass, the cost of electrodes, and, consequently, the overall cost of treatment. Thus, the efficiency and sustainability of these methods are directly related to the development of new materials for use as electrodes. In this work, electrodes coated with algae biochar in combination with metal substrates were studied for their potential application in electrochemical systems, due to their low cost, high efficiency, and environmental friendliness compared to electrode materials used so far. Biomass was pyrolyzed, and with the help of an adhesive substance and a conductive material, applied onto aluminum electrodes. The microalgae biomass used in this process took place in intermittent reactors. After collecting, it was dried, activated, and modified with the addition of iron (hematite and magnetite) in different ratios (iron to biomass) to investigate the reductive ability of the biochar in removing nitrates. Additional modifications included treatment with red pepper, lyophilization, iron incorporation, and activation (intermediate and final pyrolysis) to study a two-dimensional nitrogen-iron bonding carbon network as a catalyst. The efficiency of electrodes was examined by conducting cyclic voltammetry measurements for the reduction of nitrates and nitrites using the new electrodes as the cathode and platinum (Pt) as the anode. Comparative CV diagrams of nitrate and nitrite reduction were obtained for different concentrations and scan rates. The cyclic voltammetry plot for a bare aluminum electrode did not show strong reduction peaks upon the addition of nitrate (NO_3^-) or nitrite (NO_2^-), and the electron transfer calculated from the plots was small. One of the most important findings of this study regards the electrodes coated with iron-free biochar coating: Distinct reduction peaks (-0.5V) appear when NO_3^- or NO_2^- is added to a 0.5M Na_2SO_4 electrolyte, with greater electron transfer compared to the uncoated electrode. This indicates an expected increase in nitrate reduction during the experimental application. For the electrodes with hematite and magnetite biochar coating, multiple reduction peaks (0V , -0.6V , -1V) were observed, corresponding to the sequential reduction of NO_3^- to NO_2^- , then to hydroxylamine (NH_2OH), and finally to ammonium (NH_4^+). In the case of hematite biochar coating electrodes, the reduction peaks (0V , -0.6V , 1V) were slightly shifted and more intense, suggesting a higher degree of intermediate product formation and enhanced catalytic activity.

Keywords—drinking water denitrification; electrode materials; decontamination

Regulatory and Governance Aspects of 5G and Beyond

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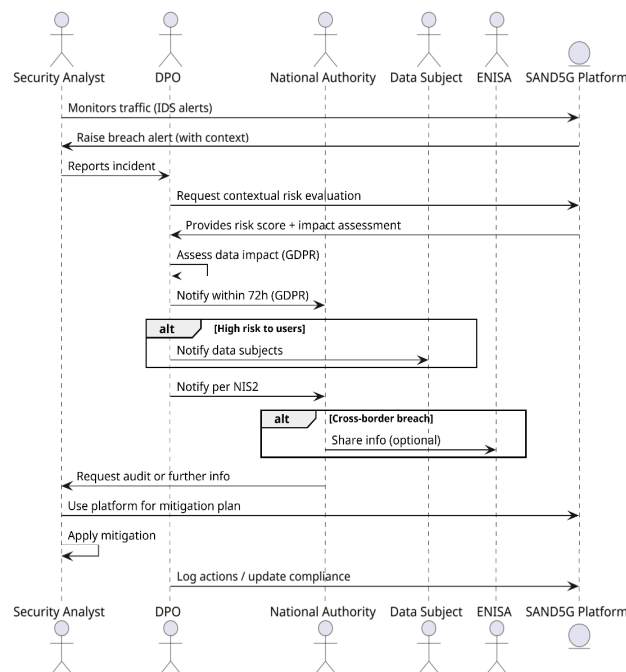
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Abstract—The rapid deployment of 5G networks introduces new opportunities for digital transformation while exposing critical vulnerabilities across technical and regulatory domains. This paper offers a comprehensive exploration of the European cybersecurity landscape for 5G and beyond, analyzing how legislative frameworks such as GDPR, the EEC, and NIS2 shape telecom security practices. It examines the roles of key actors, including ENISA, national regulatory authorities, and international bodies, and discusses how telecom operators can implement and operationalize these frameworks. The paper further presents a practical use case demonstrating how the SAND5G platform supports compliance and incident response through contextualized risk assessment and real-time threat mitigation. Looking ahead, it outlines future governance challenges and emerging technologies—such as quantum cryptography, zero trust architectures, and AI-driven security—required to secure next-generation networks like 6G. The study underscores the need for dynamic, multi-layered, and forward-looking cybersecurity strategies that balance innovation with resilience.

Keywords—SAND5G platform; 5G security; cybersecurity regulations



Security breach mitigation process using the SAND5G platform under GDPR and NIS2 directives.

A New Approach to the Beam Calculus Made of Functionally Graded Materials

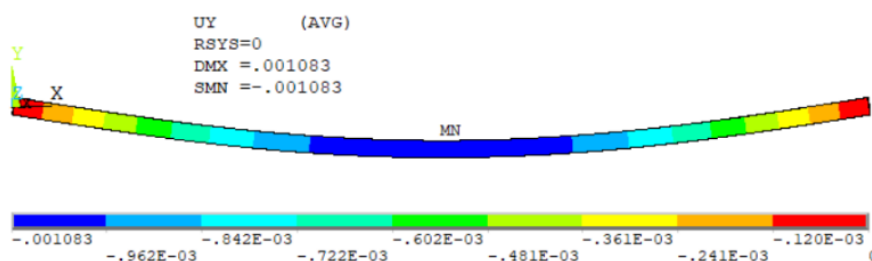
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Abstract—The use of functionally graded materials is increasingly used, from the simplest structural elements to the most complex or dedicated ones, in more and more fields of engineering creation. Under these conditions, both the manufacture of these materials and the development of their calculation are also in an appropriate development. This work is placed in the field of developing the calculation of mechanical structures from functionally graded materials, in conditions of accuracy, efficiency, economy, and accessibility for designers and scientific researchers in the field. The beam we researched is the Euler-Bernoulli beam - the type most approached in mechanical engineering constructions. The new approach proposed by the authors is based on the use of two concepts (defined and used) original to the field addressed: the concept of ultra-layered material and the concept of equivalent material. In this work, the research results refer only to the calculation of displacements in bars subjected to bending. In the research carried out, the variation (according to the material law) of both Young's modulus and Poisson's ratio was taken into account. The method, methodology, and models presented are theoretically substantiated and supported by practical examples, with general validity. The validation of the new approach in the calculation of bent beams is carried out on simple examples, with well-known analytical solutions, by applying it both to the beam made of homogeneous and isotropic material, and to the beam made of a functionally graded material, made according to the power law of the material, for different values of the power coefficient. An important aspect of the authors' research is the fact that the approach to the calculation of bent bars made of functionally graded materials is accessible to numerical calculation without developing an appropriate software, but using general calculation programs using the finite element method. Based on our research, we state, without demonstrating in this paper, that the proposed approach is also suitable for calculation by numerical methods of the meshless and meshfree type. The work is distinguished by its novelty and originality and is part of the general effort to develop the calculation of structures made of functionally graded materials.

Keywords—functionally graded materials; finite element method; beam calculus



Deformed state of the functionally graded beam

A Study on the Influence of Heat Treatment on the Mechanical Tensile Characteristics of Parts Additively Manufactured by Thermoplastic Extrusion of PETG

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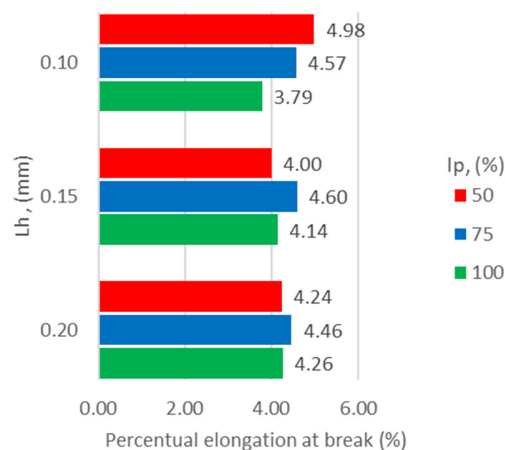
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Abstract—This paper presents a study on the influence of heat treatment on the mechanical tensile characteristics of parts additively manufactured by thermoplastic extrusion of PETG. To carry out the study, 27 tensile specimens were additively manufactured from PETG on the Anycubic 4Max Pro 2.0 3D printer using the layer height deposited per pass $L_h = (0.10; 0.15; 0.20)$ mm and the filling density $I_d = (50; 75; 100)$ %. The tensile specimens additively manufactured from PETG were subjected to heat treatment with the parameters: temperature $T = 75$ °C and duration $d = 180$ minutes. The tensile specimens additively manufactured from PETG and heat-treated were tensile tested on the Barrus White 20 kN universal testing machine, and the results show that the heat treatment led to an increase in the tensile strength of the tensile specimens by 5.90–17.88% compared to the additively manufactured PETG specimens that were not heat-treated.

Keywords—FDM; heat treatment; experimental study; tensile strength



Average percentual elongation at break of annealed tensile samples made by thermoplastic extrusion of PETG filament.



Invited Speech

On the Role of Self-Similar Symmetries in Emotionally Intelligent Learning Systems for Ecological Awareness

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Abstract—The challenges faced by education in the 21st century, particularly in relation to environmental sustainability, render essential the utilization of innovative technologies such as Artificial Intelligence, aiming to foster ecological awareness. Of particular interest is the development of intelligent electronic environments capable of detecting and dynamically responding to human presence. Such systems operate as intelligent agents that perceive environmental data and adapt their behavior to optimize interaction with users. A central research focus lies in analyzing emotional responses as a nonlinear dynamical system. Basic human emotions, modeled as functions of environmental stimulation $\varphi(t)$, are described by the expressions $\psi = A \cdot e^{\beta \cdot \varphi}$ or equivalently $\psi = A \cdot \hat{\varphi}^{\beta}$, where the constant β represents a critical self-similarity parameter. Its estimation can be performed either through statistical regression of empirical observations or through a qualitative investigation of the system's dynamic behavior. The system's asymptotic behavior - represented by the attractor- reflects the stabilization of emotional responses over time. This phenomenon is observed in numerous complex structures, such as neural networks. Consequently, such intelligent systems possess the potential to develop autonomous classifications of environmental contexts and respond in ways that serve ecologically critical objectives.

Keywords—*machine learning; emotional artificial intelligence; self-similarity; dynamical systems; environmental education*



Water and Proper Wastewater Management as a "Means" of Development and Prosperity

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Abstract—The Municipal Water Supply and Sewerage Company of the Municipality of Ancient Olympia designed, included in the development financing program of the Ministry of Interior entitled "Antonis Tritsis," and is implementing three major infrastructure projects concerning both: a) the modernization, improvement, and expansion of sections of the external and internal water supply networks of the settlements of the Municipality of Ancient Olympia, and b) the construction of a complete sewerage network for the proper and environmentally friendly management of urban wastewater in three additional settlements (Pelopio, Platanos, and Flokas), as well as the modernization of the existing infrastructure of the Wastewater Treatment Plant (WWTP) of Ancient Olympia, to upgrade its operation. The total budget (according to the initially approved studies without modifications) amounts to €9,074,767.74.

Keywords—*Municipality of Ancient Olympia; water management; wastewater management*



Innovating Regional Planning in Coastal Zones: Participatory Approaches to Counter Overtourism

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Abstract—Coastal regions across Southern Europe are facing mounting pressures from overtourism, which intensifies spatial inequalities, degrades environmental assets, and marginalizes local voices in planning processes. Traditional top-down governance frameworks often lack the flexibility and responsiveness required to address these evolving challenges. This presentation explores an alternative pathway: participatory planning as an innovative and adaptive approach to regional coastal sustainable development. Drawing on field-based research and collaborative initiatives – integrating multiple spatial tools, e.g., Geographic Information Systems - a series of participatory processes in coastal communities affected by tourism-driven transformation is presented. The research emphasizes the role of co-creation methodologies, including participatory mapping, visioning workshops, and community charrettes, in facilitating inclusive decision-making and generating place-sensitive planning outcomes. These approaches help visualize contested spatial narratives and reframe the planning discourse around local identity, heritage, and environmental stewardship. Special focus is given to how these methods have been integrated into pilot planning exercises in Greek coastal regions, where diverse stakeholder engagement has led to alternative spatial strategies rooted in community resilience. By showcasing these practices, the presentation underlines the potential of participatory planning not only as a tool for mitigating overtourism but also as a catalyst for institutional innovation in regional governance. Ultimately, the work contributes to an emerging planning paradigm that leverages local knowledge to advance sustainable, inclusive, and future-proof coastal development.

Keywords—*participatory planning; overtourism; coastal areas; community resilience; geographic information systems*



1st International Conference on Engineering, Technology and Applied Science Innovations
(ICETASI 2025)

Oceans as Global Commons: Reality, Challenges, and Possibilities

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Abstract—This thesis examines the oceans through the lens of the concept of global commons. Its purpose is to demonstrate that the oceans are indeed a global commons, yet there are restrictions and regulations on how they should be exploited and managed to ensure their sustainable use for future generations. In other words, the oceans belong to those resources that all of humanity has access to - or at least should have - and that need to be used sustainably and fairly. Initially, the commons are presented in a general context, focusing on the characteristic elements and characteristics of the global commons. Particular emphasis is placed on the work of Elinor Ostrom and how it can support global commons, with a reference point to polycentric governance. Then, the characteristics and particularities of the oceans, the emerging problems, and the challenges at an economic, ecological, and political level are formulated. In addition, ocean regulation and governance frameworks are analyzed and, finally, proposals regarding the future of the oceans as a global community are presented.

Keywords—*global commons; laws and regulations; polycentric governance; oceans*

University Drop-Out: The Case Study of the Petroleum-Gas University of Ploiesti

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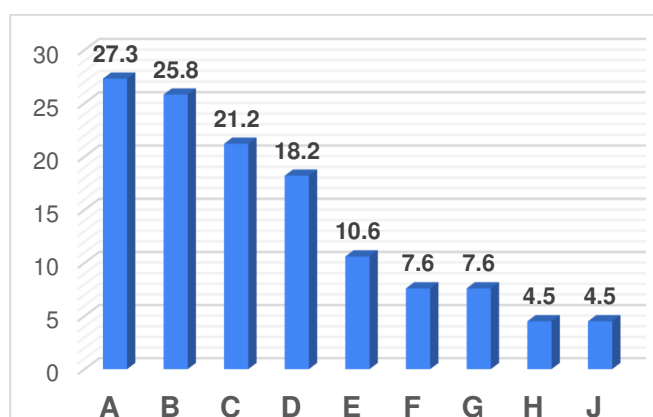
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Abstract—University drop-out is at present the greatest scourge of the Romanian academic education. The main goal of the present paper consists of the identification of the principal factors leading to drop-out and consequently of the most efficient modalities of prevention and control of this phenomenon in the Petroleum-Gas University of Ploiesti (PGUP). To that purpose, an interdisciplinary study regarding the difficulties encountered by the students in their adaptation to the PGUP environment has been performed. The results of this study, based on a questionnaire distributed to the subjects in a high-risk situation, are summarized and commented on in this paper. A predictive model trying to assess the future evolution of university drop-out for the PGUP engineering faculties has also been developed by the authors.

Keywords—university drop-out; case study; University of Ploiesti



Distribution of the motives favouring the university dropout: A – lack of time; B – financial problems; C – stress accumulation; D – a parallel job; E – lack of interest / uselessness of continuing the academic studies; F – inadequate choice of the study program; G – negative attitude of the professors / inadequate teaching methods; H – motives connected to the family; J – other motives.

Assessing the Accuracy of ERA5-Land in Heatwave Monitoring

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Abstract—This study investigates the ability of reanalysis data to accurately identify heatwave events (HEs) in Greece from 1960 to 2022. High-resolution gridded reanalysis data from ERA5-Land, providing consistent land variables, namely maximum daily temperature over several decades, are utilized. In addition, HEs have been identified through high-quality homogenized meteorological data provided by the Hellenic National Meteorological Service (HNMS) from 1960 to 2022. The HEs are identified through a percentile-based threshold, calculated via a bootstrap resampling methodology to address artificial discontinuities in the reference period of 1961-1990. Furthermore, the HEs from both datasets are analyzed in terms of frequency, duration, and severity of events. Finally, the HEs calculated from the ERA5 dataset are assessed across five intensity classes derived from five percentile-based thresholds to evaluate their accuracy in capturing these events. Expected results reveal the strengths and weaknesses of ERA5-Land data in capturing heatwave characteristics across different climate regions of Greece. This study will provide insights into the reliability of ERA5-Land as a tool for heatwave monitoring and risk assessment, informing the development of more effective heat-health action plans and climate adaptation strategies. The findings will be particularly relevant for regions with limited observational data, where ERA5-Land can serve as a valuable source of information.

Keywords—heatwave; Greece; severity; duration; frequency; reanalysis; climate

Results: TX Comparison

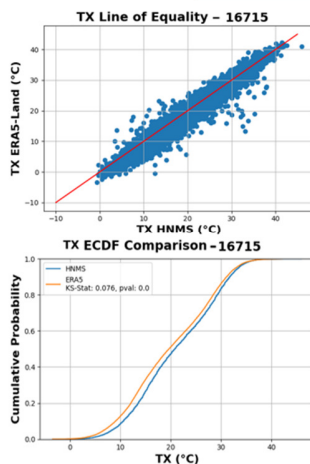


Figure 2: (a) Line of equality and (b) CDF lines of the spatially interpolated, through IDW, ERA5-Land and HNMS weather station TX data for station 16715.

Table 2: KS Test results between ERA5 and HNMS TX timeseries.

Station Code	KS Statistic	p-value
16606	0.1449	0
16613	0.1521	0
16614	0.0971	0
16618	0.1063	0
16619	0.1985	0
16628	0.2492	0
16632	0.0560	0
16642	0.0993	0
16645	0.0881	0
16648	0.0623	0
16654	0.1890	0
16665	0.0631	0
16672	0.1432	0
16674	0.0944	0
16675	0.1714	0
16699	0.0601	0
16710	0.0862	0
16715	0.0763	0
16718	0.1328	0
16724	0.1581	0
16727	0.2133	0
16760	0.0548	0
16761	0.1159	0
16840	0.1769	0
16851	0.0884	0
16854	0.1936	0

- **Strong agreement** between ERA5-Land TX data and HNMS station measurements, with points closely aligned to the line of equality.
- CDF analysis shows similar distribution patterns, with **higher correlation at extreme TX values**.
- KS tests indicate **statistically significant agreement across all stations** ($p \approx 0$), with KS statistic values ranging: 0.056 - 0.213.
- 6 stations (16619, 16628, 16654, 16675, 16727, 16840, 16854) show slight underestimation by ERA5-Land compared to observations.

An Adaptive System Architecture for Creating Visual Stories for Children on the Autism Spectrum

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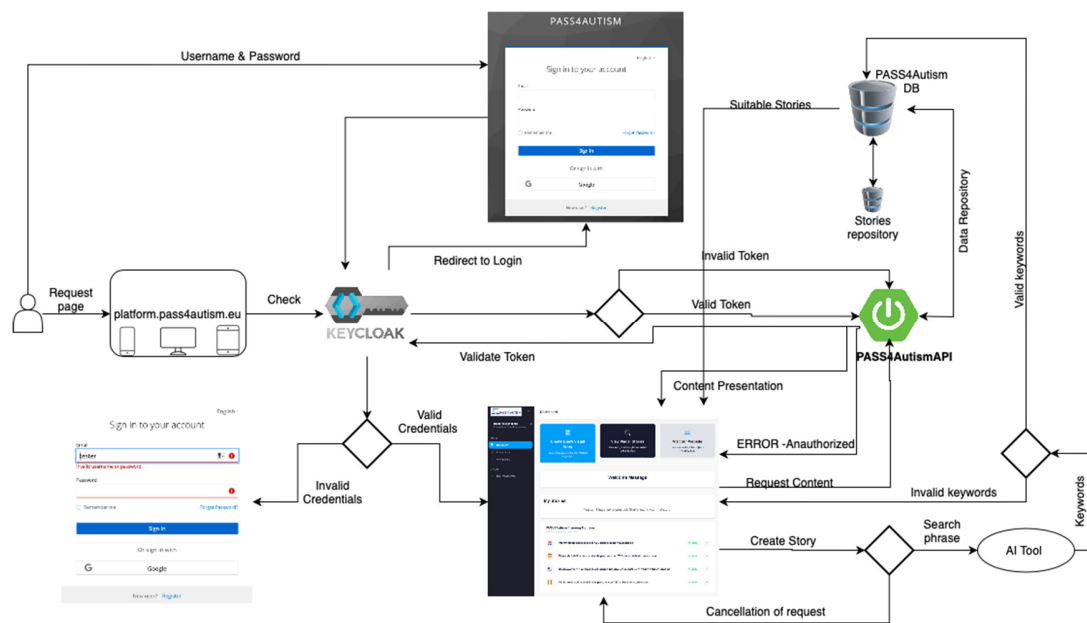
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Abstract—Children with ASD need personalized therapy to overcome social and emotional difficulties that they experience in their daily routine. They have hugely varied, heterogeneous needs, and should therefore be well served by services truly tailored to an individual, with all of his/her personal needs and preferences. As they learn better visually, visual stories are often a valuable tool for their education and their everyday life. In this paper, we propose a tool that enables parents to make their own visual stories using artificial intelligence in order to be personalized to every child's needs.

Keywords—autism; visual stories; AI tool



System Architecture



Mediterranean Coastal Naturalness Dynamics (1985–2024) Using Vegetation Indices and Land-Use/Land-Cover Data in Google Earth Engine

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Abstract—The Mediterranean Coastal Zone (MCZ) is a narrow yet complex region where land meets the sea, characterized by its unique blend of rich biodiversity, cultural traditions, and economies that are predominantly dependent on tourism, shipping, and fisheries. Stretching across coastal areas in Southern Europe and Western Turkey, the MCZ faces pressure from urban expansion, industrial activities, and climate change, including rising sea levels and shifting weather patterns. This research aims to assess long-term changes in "naturalness" within the MCZ over 39 years (1985-2024) by utilizing annual, cloud-free Landsat satellite composites through Google Earth Engine, a platform commonly used to handle large datasets. Long-term averages for two spectral indices, the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Moisture Index (NDMI), were computed to identify trends in vegetation health. The analysis revealed varying trends throughout the MCZ, with specific areas showing minor declines in vegetation, while others experienced increases or remained stable. Insights derived from Corine Land Cover data provided essential context for these variations, underscoring issues related to changes in land cover, including agricultural expansion, urbanization, and the loss of natural habitats. By employing spectral indices and land cover analysis, this study uses a framework for assessing ecological vulnerabilities in coastal regions. This approach enhances our understanding of "naturalness" dynamics and supports conservation efforts, particularly given the MCZ's significance as a vital coastal ecosystem.

Keywords—coastal zone; vegetation indices; LU/LC; NDVI; NDMI



Invited Speech

The MTG-I Lightning Imager: Detecting Lightning from Space and Much More

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Abstract—The MTG-I Lightning Imager (LI) is a groundbreaking instrument on-board the MTG-I geostationary satellites, designed to provide continuous lightning detection from space. This instrument delivers accurate, timely data essential for early storm detection. By integrating these observations, meteorologists can estimate precipitation and address lightning, wildfire and aviation risks. These capabilities improve severe weather monitoring and response, helping to protect lives and property. In addition to detecting lightning, the LI has demonstrated its capability to detect other phenomena such as meteors, space debris, and explosions. These additional capabilities represent potential useful innovations that were not fully foreseen at the time of launch. This presentation will cover the technical aspects of the Lightning Imager, its primary use in lightning detection, and potential new in-flight applications.

Keywords—*MTG-I Lightning Imager; lightning detection; wildfire detection; geostationary satellites*

Neurocognitive Approaches to Fraction Learning: Integrating EEG, fMRI, and Eye Tracking in Mathematics Education

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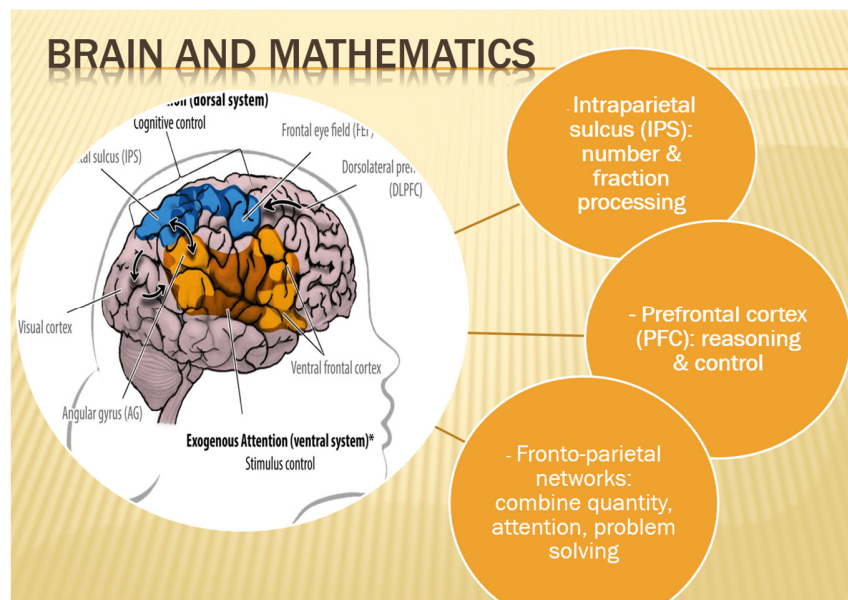
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Abstract—This paper reviews neurocognitive studies using EEG, fMRI, and eye-tracking to investigate how learners understand fractions. While challenges with fractions are well documented, most research has focused on adults, leaving children underrepresented. The review highlights how the brain processes symbolic and nonsymbolic fractions, the involvement of regions such as the intraparietal sulcus, and the role of visual attention and neural timing in mathematical reasoning. It also examines how targeted instruction can reshape brain activity related to fraction magnitude estimation. Emphasis is placed on the promise of portable EEG devices for real-time classroom use, supporting personalized and responsive teaching. The findings underscore the potential of educational neuroscience to inform more effective and developmentally appropriate practices in mathematics education.

Keywords—educational neuroscience; fractions; EEG; fMRI; eye tracking; mathematical cognition; precision education



A Study on the Optimization of FDM Parameters for the Manufacture of Flexural Specimens from Recycled ASA in the Context of the Transition to the Circular Economy

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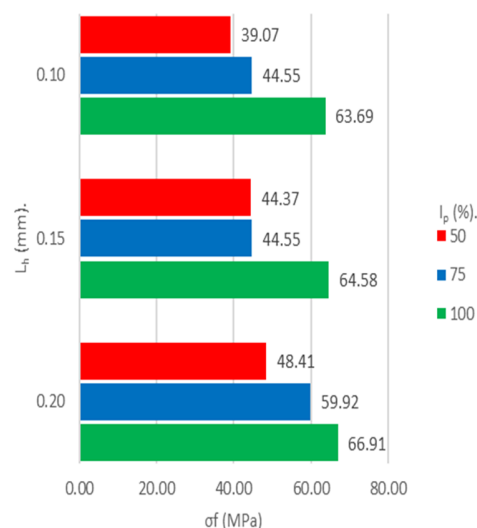
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Abstract—This paper presents the results of the study on the optimization of 3D printing parameters by FDM for the manufacture of recycled ASA specimens intended for experimental determinations for the 3-point bending test. To carry out the study, using the QIDI Q1 Pro 3D printer and variable FDM parameters [layer height deposited in one pass, $L_h = (0.10; 0.15; 0.20)$ mm and filling density, $I_d = (50; 75; 100)$ %], 45 specimens for the 3-point bending test were manufactured from recycled ASA. All 45 specimens were tested for bending on the Barrus White 20 kN universal testing machine. The results of the study show that both parameters considered (L_h and I_d) influence the maximum bending stresses (σ_f) of the additively manufactured rASA specimens, the influence of I_d being 55.89% greater than the influence of L_h .

Keywords—FDM; flexural; experimental study; FDM parameters



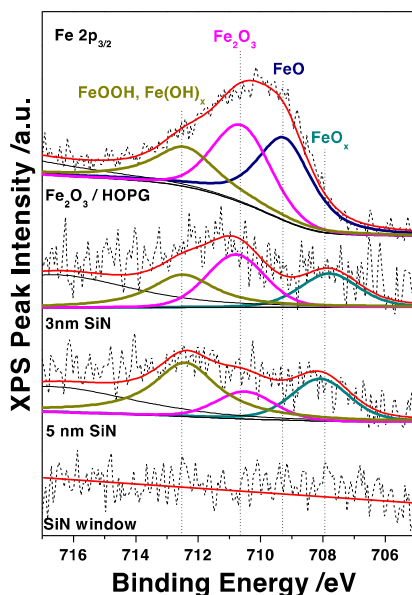
Average flexural strength of rASA 3-point bending specimens.

Depth Dependent Chemical Information in the Liquid-Solid Interface of Nanoparticles in Solutions by Conventional X-Ray Photoelectron Spectroscopy

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Abstract—Iron oxides are promising materials for a wide range of applications, including photocatalytic water splitting, energy storage, and heterogeneous catalysis. However, understanding the interaction between iron oxide nanoparticles (Fe_2O_3 nps) and liquid water at the molecular level remains challenging due to the limitations of conventional surface analysis techniques. In this study, we present an in-situ X-ray Photoelectron Spectroscopy (XPS) investigation of Fe_2O_3 nps suspended in aqueous solution using a custom-designed environmental cell (e-cell), sealed with ultrathin silicon nitride (SiN) membranes. The attenuation of Fe 2p photoelectrons through 3–5 nm thick membranes was modeled and experimentally verified, enabling successful detection of chemical states within the aqueous suspension. Depth-relevant information revealed a layered structure of the nps, with surface hydroxide species, an Fe_2O_3 core, and an intermediate FeO_x phase. Spectra close to the valence band region confirmed the liquid nature of the encapsulated solution via the detection of water molecular orbitals, while ionic Na^+ signals further demonstrated the method's capability for detecting dissolved species. This approach provides a powerful platform for real-time chemical analysis of solid-liquid interfaces under ambient-like conditions, with broad implications for catalysis, electrochemistry, and environmental science.

Keywords—in-situ XPS; iron oxide nps; solid-liquid interface; environmental cell; aqueous suspension; redox chemistry; dissolved ions



Fe 2p photoelectron spectra acquired from the e-cell filled with Fe_2O_3 np aqueous suspension without charge neutralization in comparison to the Fe 2p spectrum acquired from the dried Fe_2O_3 np aqueous suspension on HOPG.

Invited Speech

From Embedded to Cyberphysical Systems, AI and Beyond

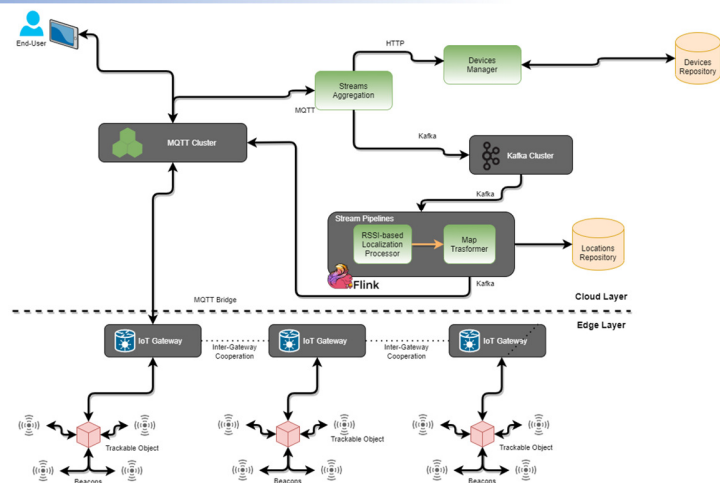
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Abstract—Cyber-physical Systems of Systems (CPSoS) are large, complex systems where physical elements interact with many distributed computing elements and human users. The main challenges associated with the design and operation of reliable connected CPSs stem from continuously increasing demands for resource availability, novel services of high added value and product quality, while adhering to requirements for low cost, low power, and competitiveness in the global market. This paper puts forward a set of CPSoS systems aiming at developing models, architectures, and software tools for allocating computing resources to CPS end devices, while autonomously detecting what cyber-physical processes will be performed by the device components, including heterogeneous CPU elements and communication interfaces, GPUs, FPGA fabrics, and Software stacks. Collaborating in a decentralized way and ensuring the exchange of tasks and data without central intervention, the proposed projects are leveraging state-of-the-art artificial intelligence technologies to improve their performance, reliability, robustness, as well as security.

Keywords—cyber-physical systems of systems; embedded systems; machine learning; AI; performance; low power

System – High Level Architecture

- **Edge Layer**
 - BLE Beacons
 - Trackable Objects
 - IoT Gateway
- **Cloud Layer**
 - Messaging Brokers
 - Data Stream Pipelines
 - Data Storage
 - Locations
 - Devices





Invited Speech

On the BBNJ Agreement

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Chairperson of the Environment Committee of the Hellenic Parliament,
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Abstract—The BBNJ Agreement is one of the most ambitious international legal frameworks ever developed for the protection of the oceans. It is not simply another treaty; it is a historic milestone that embodies a new global commitment to safeguarding the marine commons. It has been characterized as the most significant development in the law of the sea since UNCLOS itself, filling a critical governance void over nearly two-thirds of the ocean's surface. Greece signed the Agreement on 20 September 2023 in New York and ratified it on 8 May 2025, fulfilling a commitment announced publicly by our Prime Minister, Kyriakos Mitsotakis, at the 9th International Ocean Conference in Athens. In ratifying the Agreement, Greece aligned with over 140 states and the European Union that have already signed, and joined the pioneers working to bring it swiftly into force. This is not only a legal act, but a clear declaration that the oceans must be managed as a shared responsibility of humankind.

Invited Speech

Integrating EEG, Biomechanical, and Analytical Methods to Assess the Impact of Traditional Practices like Taijiquan (Tai Chi Chuan) on Quality of Life

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Abstract—This talk will review multidisciplinary approaches that combine artificial intelligence, biomechanical measurements, physiological monitoring, and advanced analytics to study the impact of traditional mind-body practices, such as Taijiquan, on quality of life. Emphasis is placed on frameworks that integrate subjective assessments—through structured surveys—with objective techniques, including EEG recordings, depth cameras, and motion analysis systems for capturing movement characteristics and functional performance. Multivariate statistical modeling and composite scoring methods can help synthesize and interpret these diverse data into standardized indicators of well-being. The presentation will discuss key concepts, methodological considerations, and examples of applications demonstrating how physiological recordings, biomechanical analytics, and self-reported data can be combined to evaluate public health interventions involving traditional practices. Future directions and opportunities for integrating these approaches into personalized health promotion and evidence-based practice will also be highlighted.

Keywords—quality of life; multimodal assessments; EEG; biomechanics; surveys; Taijiquan (Tai Chi Chuan)

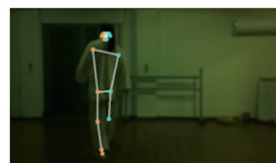
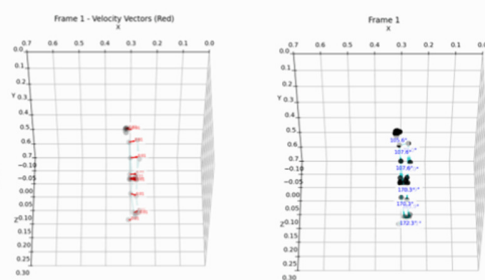
TAIJIQUAN AND BIOMECHANICS

Materials and Methods:

Low-cost, computer vision-based motion capture system with MediaPipe Pose estimation

Live kinematic data was extracted from novices (5-10 classes), intermediates (25-30 classes), and experts (over 10 years).

Movement fluidity was quantified via jerk analysis, and coordination by phase analysis, including Mean Absolute Relative Phase (MARP) and Deviation Phase (DP).





Contrast-Enhanced Spectral Mammography—A New Approach in Breast Imaging Compared to MRI

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Abstract—This presentation will outline the fundamental technical features of Contrast-Enhanced Spectral Mammography (CESM), an advanced breast imaging technique that is increasingly regarded as an alternative to MRI mammography. Mammography has been the primary imaging method for breast cancer screening and diagnosis over the past 30 years, particularly given that breast cancer remains the most common cancer among women. In a standard 2D mammography exam, each breast is compressed twice to capture four X-ray images. CESM combines traditional mammography with the intravenous injection of an iodinated contrast agent (ICA). Following contrast administration, dual-energy exposures (typically between 26–33 kVp and 44–50 kVp) are used to differentiate enhancing lesions from normal breast tissue. This technique leverages the higher contrast uptake seen in malignant tissue, improving the visibility of suspicious findings.

Keywords—mammography; Contrast Enhanced Spectral Mammography (CESM); dual energy



An Applied Science Approach to Managing Healthcare Businesses: Leveraging Technology and Regulation

Fon Hah

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Abstract—Computer systems are vital for the healthcare industry. The main objective of the paper is to highlight how applied science – specifically, computer science – can help to manage healthcare businesses such as medical practices (clinics) in Australia. This paper explores two domains (Peter Drucker’s principles of management and Nikola Tesla’s vision of automation and systemization), utilizing applied sciences. It first addresses the principles of business management of medical clinics, utilizing technology such as application programming interfaces (API), clinical decision support systems, relational database management systems, and software applications. Next, it emphasizes regulatory compliance for the prescription of medical drugs, focusing on automation and systemization of processes. The management of healthcare businesses is based on regulatory frameworks, giving rise to computational models to manage business and clinical variables to ensure compliance. In simplified terms, software applications, particularly practice management software (PMS), are used in medical practices and specialist surgical clinics to schedule appointments, deliver AI-assisted voice-to-text transcription of patient diagnosis, invoice patients for medical consultations, process claims reimbursements from private and public health insurers for surgical procedures across multiple clinical specialties, submit requests and receive results for diagnostic imaging and pathology tests, manage electronic health records and issue electronic drug prescriptions for all known patient treatments approved by a national government. This paper explores how computing systems used by medical practices can help to deliver regulatory compliance and improved patient outcomes. Drawing upon Peter Drucker’s principles of management and Nikola Tesla’s vision of automation and systemization, this study examines how data-driven computations and decisions, and algorithmic management of prescribed pathways for patient care and insurance reimbursements, achieve streamlined operations and drive efficiency in healthcare businesses.

Keywords—software development; practice management software; healthcare technology; obstetrics and gynecology software; electronic prescriptions; pathology and diagnostic imaging; application programming interfaces API; relational databases; structured query languages SQL; clinical decision support systems

Performance Comparison of Lutetium- and Gadolinium-Based Scintillators for Medical Detector Applications

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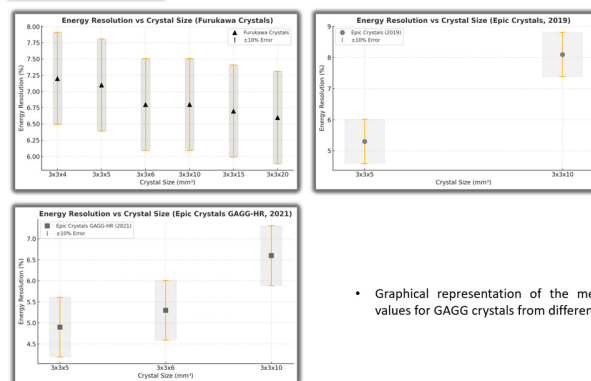
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Abstract—Scintillation materials are foundational to photonic technologies used in radiation detection, particularly in medical applications. Solid-state crystalline scintillators are extensively employed for the detection of gamma radiation, where they convert high-energy photons into visible light that can be measured by photomultipliers. The performance of these materials is influenced by several intrinsic properties, which in turn affect the overall energy resolution of the detector. Among the available options, lutetium-based and gadolinium-based scintillators have attracted significant interest due to their favorable physical and optical characteristics. This study focuses on three commercially available scintillator crystals: LFS-3, LYSO, and GAGG of various sizes. LFS-3 (Lutetium Fine Silicate) and LYSO (Lutetium Yttrium Orthosilicate) are both lutetium-based materials characterized by high density ($\sim 7.3 \text{ g/cm}^3$), short decay times ($< 40 \text{ ns}$), relatively high light yields ($\sim 32,000 \text{ ph/MeV}$), and good energy resolution ($\sim 11\%$). GAGG: Ce (Gadolinium Aluminum Gallium Garnet) is a gadolinium-based scintillator known for its high light output ($46,000 \text{ ph/MeV}$) and excellent energy resolution ($\sim 7\%$). GAGG: Ce, LFS-3, and LYSO scintillator crystals were measured and compared under identical experimental conditions in a stable temperature inside a light-tight black box. All crystals were optically coupled to a silicon photomultiplier (SiPM) to ensure optimal light collection. For the LFS-3 and GAGG series, $3 \times 3 \text{ mm}^2$ pixellated crystals with varying thicknesses (ranging from 4 mm to 20 mm) were evaluated using a 662 keV gamma-ray source. Energy spectra were acquired for each sample to determine the key performance parameter of energy resolution. Signal digitization, triggering, and data acquisition were carried out using a CAEN desktop digitizer along with DPP-CI software for pulse processing. The results showed that all crystal samples demonstrated excellent energy resolution performance, confirming their strong potential for use in next-generation nuclear medical imaging systems.

Keywords—inorganic scintillators; silicon photomultiplier; energy resolution; lutetium fine silicates; lutetium orthosilicates; $\text{Gd}_3\text{Al}_2\text{Ga}_3\text{O}_{12}$: Ce

Scintillators Results



- Graphical representation of the measured energy resolution values for GAGG crystals from different manufactures.



Experimental Evaluation of Single-Crystal GAGG: Ce Scintillators with Photomultiplier (PMT) and Silicon Photomultiplier (SiPM)

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Abstract—This study presents the experimental evaluation of single-crystal GAGG: Ce scintillators using two gamma-ray photodetectors: the conventional photomultiplier tube (PMT) H1949-51 from Hamamatsu and the modern silicon photomultiplier (SiPM) PM3350 from KETEK. Scintillators of three sizes ($10\times10\times10\text{ mm}^3$, $3\times3\times10\text{ mm}^3$, and $3\times3\times5\text{ mm}^3$) were optically coupled with both detectors. Energy spectra produced by the irradiation of three radioactive sources (^{137}Cs , ^{133}Ba , and ^{60}Co) were acquired, digitized, and analyzed using the CAEN DT5720 digitizer and dedicated digital pulse processing software. The evaluation of the detector assemblies focused on energy resolution, sensitivity, and linearity under identical conditions. The SiPM achieved superior energy resolution with a best value of 2.8% at 1332 keV (using the $3\times3\times5\text{ mm}^3$ GAGG: Ce crystal), outperforming the PMT, which exhibited a best resolution of 5.9% at 1332 keV for the same crystal. The largest crystal ($10\times10\times10\text{ mm}^3$) provided the highest sensitivity, reaching ~2% for ^{137}Cs with the SiPM. The PMT exhibited excellent linearity in the whole energy range studied, while the SiPM required correction for non-linearity. These results highlight the advantages of SiPMs for high-resolution gamma spectroscopy. The findings offer practical guidance for the optimal selection of scintillator-detector assemblies in advanced gamma-ray detection systems.

Keywords—GAGG: Ce scintillators; gamma-ray spectroscopy; silicon photomultiplier



Investigation of Wind Turbine Grounding System Efficiency

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Abstract—Wind turbines are leading the energy transition regarding the installed MW around the world and could play a key role in the EU energy targets of 2030. Wind turbines are mainly installed in mountainous and complex terrains, particularly in the Mediterranean region, while the number of installations in flat terrains is increasing. The size of the structure makes it vulnerable to lightning strikes, which could cause severe damage to the equipment and personnel. The aim of this study is to investigate the efficiency of a wind turbine Lightning Protection System (LPS) in protecting wind turbine components and crew members. The behavior and the efficiency of the grounding system of a wind turbine LPS were studied for two different types of lightning strikes with peak currents of 150 kA and 200 kA and times of 1.2/50 μ s and 19/485 μ s, respectively. The study utilized the circuit approach, in which the ground electrodes are represented by distributed circuits consisting of a series of inductances, resistors, transverse conductors, and capacitances. Different scenarios were investigated with and without soil ionization. The simulations were based on EMTP-ATP software. The simulation results provide information about the transient voltages and currents developed in the wind turbine tower and its grounding system during a lightning strike and the touch voltages that may occur in a person present during the event. Different soil conditions were examined by changing the specific resistance of the soil using protective material and estimating the effect of soil ionization. The study demonstrates the performance and the efficiency of an onshore wind turbine grounding system and can be used as a basis for further optimization of the balance of plant works (foundation design) to reduce the investment and operational costs.

Keywords—wind turbines; efficiency; wind turbine lightning protection system; grounding systems

Ground Resistance Measurements and Evaluation of Grounding Electrodes Performance

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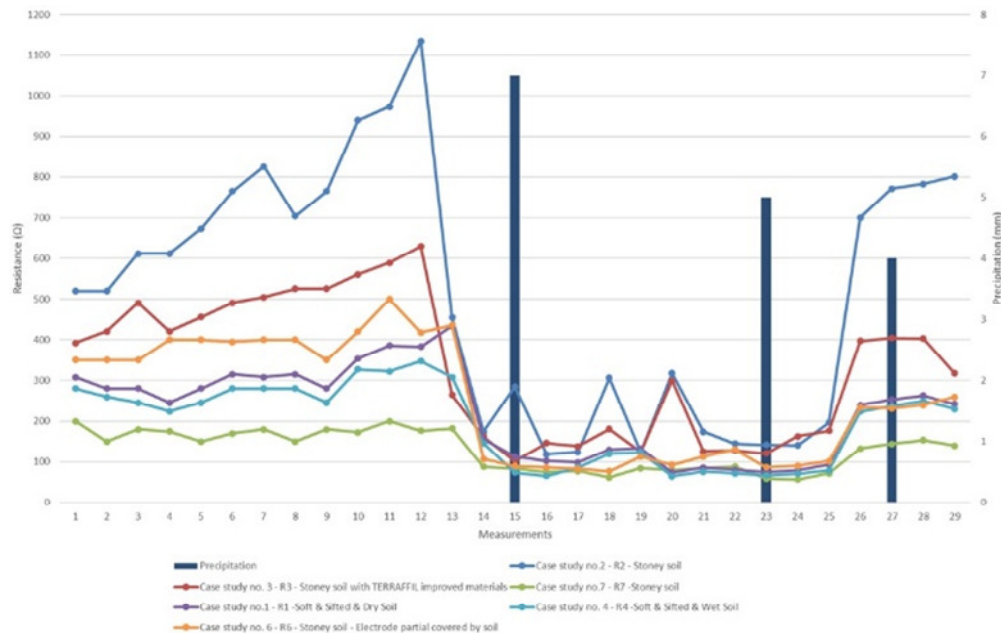
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Abstract—This paper presents an experimental study on grounding resistance measurements carried out at the University of Patras. Seven case studies are examined to analyze the impact of soil type, electrode geometry, and grounding system configuration on measured resistance values. The findings highlight key factors affecting grounding performance and provide a basis for optimizing system design in varying soil conditions.

Keywords—earth electrodes; grounding system; ground resistance; soil resistivity



Type of Soil effect on Grounding Resistance – depth length effect of grounding electrode disabled



Assessment of Air Quality in A Primary School Classroom Using High-End Instrumentation and Low-Cost Sensors

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Abstract—This study evaluates the Indoor Air Quality (IAQ) of an elementary school classroom in Athens, Greece, over a three-week winter period (January–February 2024), using both high-precision instruments and 2 sets of low-cost sensors (ENSENSIA) to monitor gaseous and particulate pollutants. The classroom was naturally ventilated through 14 operable windows. The primary objectives were to identify the sources of indoor air pollutants, including CO, CO₂, NO_x, O₃, Particulate Matter (PM₁), and Volatile Organic Compounds (VOCs), and to assess the performance of the low-cost sensors measuring these pollutants. Sensor evaluation was based on Mean Absolute Error (MAE), Mean Bias Error (MBE), Root Mean Squared Error (RMSE), normalized Mean Error (nME), and R-squared (R²). Special emphasis was placed on the Total VOCs (TVOCs) sensor, particularly its sensitivity to individual VOC species. Source apportionment analysis indicated that CO, NO_x, O₃, and PM₁ primarily originated from outdoor sources, whereas CO₂ and the VOCs with the highest concentrations originate from indoor sources. Although the average pollutant concentrations remained below World Health Organization (WHO) guidelines, several VOCs classified as carcinogenic or possibly carcinogenic by the International Agency for Research on Cancer (IARC) were detected. These included formaldehyde (11.7 ± 13.6 ppb), acetaldehyde (54.1 ± 65.3 ppb), butadiene (0.9 ± 1.2 ppb), benzene (0.6 ± 0.3 ppb), styrene (0.3 ± 0.1 ppb), and naphthalene (0.1 ± 0.06 ppb), measured during school hours in the classroom. The low-cost sensors showed potential in terms of sensitivity but often substantially overestimated or underestimated pollutant concentrations. While performance for PM_{2.5} and CO₂ sensors was considered adequate, CO, NO_x, and O₃ sensors required Machine Learning (ML) calibration, which significantly improved accuracy and inter-unit consistency. The TVOC sensor demonstrated promising sensitivity to total VOC concentrations measured by the Proton Transfer Reaction Time-of-Flight Mass Spectrometer (PTR-ToF-MS), achieving R² values of 0.61 and 0.70. However, it consistently underestimated total VOC levels, with an nME of 0.8 for both sensors. Further research is needed to identify the specific VOC compounds to which the sensor is most responsive and to develop ML calibration techniques to reduce measurement errors.

Keywords—indoor air quality; volatile organic compounds; low-cost sensors; ENSENSIA



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Mapping Ethical and Consumer Empowerment Metrics in AI-Driven Digital Marketing

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Abstract—AI in digital marketing has greatly improved the personalization features, at the same time creating several issues in relation to data privacy, dark patterns for manipulation, algorithmic fairness, and transparency or disclosure. This paper, given in the form of a bibliographic mapping study, takes as its purpose to systematically identify and classify the metrics used to evaluate these issues. The aim is to indicate current missing links, duplications, and standardization possibilities so that research and regulatory activities can be linked in a consistent way.

Keywords—*artificial intelligence; digital marketing; ethical metrics; consumer empowerment; dark patterns; algorithmic fairness; transparency; disclosures; personalization; standardization*



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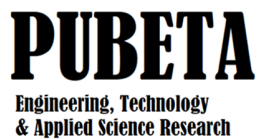
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