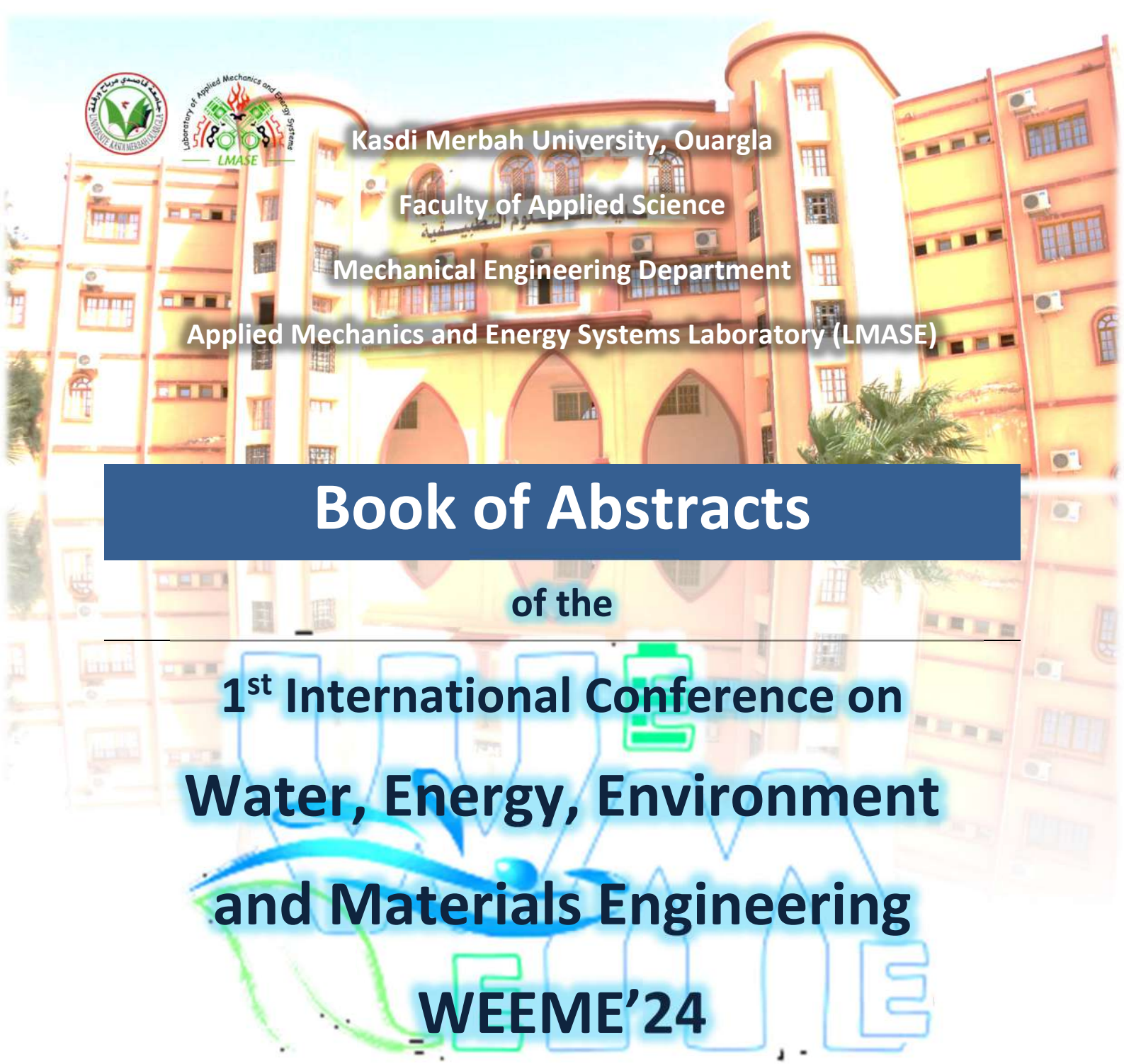

Kasdi Merbah University, Ouargla

Faculty of Applied Science

Mechanical Engineering Department

Applied Mechanics and Energy Systems Laboratory (LMASE)

# Book of Abstracts

of the

## 1st International Conference on

# Water, Energy, Environment and Materials Engineering

# WEEME'24

Ouargla, December 10th-11th, 2024

Dr. Imad KEMERCHOU

## Foreword

Amidst the escalating challenges posed by climate change and increasing pressures on natural resources, water and energy stand out as paramount elements necessitating efficient management and sustainability. In this context, the Faculty of Applied Science is delighted to announce the "1st International Conference on Water, Energy, Environment and Materials Engineering." This conference aims to assemble experts, researchers, and policymakers from around the globe to exchange ideas and knowledge and foster collaborative endeavors. The event will serve as a platform to spotlight modern innovations and cutting-edge technologies in these vital sectors, emphasizing sustainable applications that strike a balance between current needs and preserving resources for future generations.

## Aims and Objectives

The First International Conference on Water, Energy, Environment and Materials Engineering (ICWEEME-2024) aims to create a forum where prominent academic scientists, researchers, and research scholars can exchange their knowledge and share their findings concerning various aspects of Water and Materials Synthesis, Characterization, and Processing.

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# Oral Communications Abstracts

## 1st Session

## Water Management & Energy Systems

**WEEME'24-102-Or**

### ANN and WANN waves-based artificial neural network models with K-means clustering for modelling Daily suspended sediment load

**Abdelghafour DELLAL[1], Abdelouahab LEFKIR[2*]**

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**Abstract:** The developments in the field of artificial intelligence have provided solutions to many problems of researchers in the field of hydrology. Suspended sediment load is one of those problems whose modeling is considered an important role in improving planning and good management of watersheds. This research explores the idea of using pre-processing techniques for the input data set, the annual aggregation technique, the year-based aggregation technique, the K-means aggregation technique, as well as the seasonal aggregation technique and the monthly aggregation technique on the ANN and WANN waves-based artificial neural network models for modeling Daily suspended sediment load Daily flow discharge data and sediment load data were used to form 10 different input groups consisting of current and delayed daily data by one, two and three days of flow discharge in addition to sediment load data delayed by one and two days for a period of 53 years (1962-2015) at the Sacramento River, USA. The performance of the ANN and WANN models against different preprocessing techniques was evaluated and compared using the observed values of SSL based on percentage bias (PBIAS), coefficient of determination (R2), standard deviation ratio (RSR), and Nash-Sutcliffe Efficiency (NSE). Finally, the WANN model outperformed with the annual aggregation techniques and the seasonal aggregation technique, while the ANN model outperformed the K-means aggregation technique and the year-based aggregation technique, while the performance was close for both models with the monthly aggregation technique, SSL t-1 is considered late by one day according to the results of the sensitivity analysis the most important inputs affecting SSL modeling.

**Keywords:** AI, flow discharge, pre-processing techniques, suspended sediment load, Wavelet, ANN

**WEEME'24-405-Or**

### Performance investigation of innovative system designed for cereal irrigation in desert climate

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**Abstract:** In Algeria, the cereal production faces successive declines due to drought and fluctuating rains. For developing this sector, a new and creative approach is required, particularly in the areas

of irrigation and energy supply. The comparison of various existing irrigation methods and analyzing their yields leads to design an innovative irrigation system. The evaluation of this system design shows that some technical modifications are required to reduce its inertia moment. Matlab software is used to conduct a numerical simulation is conducted to examine the system performance according to operating parameters. In December, the base case results show that the irrigation of a hectare requires a total photovoltaic peak power, reaching 50 kW. This sustainable irrigation system is suitable for enhancing agricultural productivity and environmental sustainability as well.

**Keywords:** Irrigation, innovative system, cereals, performance

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**WEEME'24-103-Or**

**Optimization and Modelling of Operating Parameters for MB Adsorption by Treated Activated Carbon**

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**Abstract:** This study presents the optimization and modeling of operating parameters for the adsorption of methylene blue using treated activated carbon. The adsorption process is crucial for wastewater treatment, particularly in the removal of dyes. Key parameters such as adsorbent dosage, contact time, pH, and concentration were systematically investigated to determine their effect on adsorption efficiency. A Design of Experiments (DoE) approach was utilized to optimize these parameters and develop a robust statistical model. The results indicate that treated activated carbon is highly effective in adsorbing methylene blue under optimal conditions. This research contributes to the understanding and improvement of adsorption processes, offering practical guidelines for industrial applications in water purification. In light of the result obtained experimentally and by the simulation method, we were able to identify the appropriate factors (mass 0.5 g of adsorbent, 100 mg/L solution, and pH 5.8) for an adsorption capacity experimental of 83.07 %, and calculated of 95.69 %.

**Keywords:** Adsorption, Water treatment, Date pits, Activated carbon, Experimental design.

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**WEEME'24-413-Or**

**Obtaining a hybrid electrode based on imidazonium ion- terminated and metallic nano-clusters for battery electrode use**

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**Abstract** :Surface modification with thin organic layers is crucial for designing materials with specific properties to develop practical applications such as supercapacitors, metal-air batteries; fuel cells, corrosion resistance... In the present work, we focused on the grafting of thin film positively charged; i.e. ionic liquids (LIs) on a glassy carbon electrode (GC), then functionalized with metal nanoparticles (Pt or Pd). The SEM obtained images confirm the modified electrode. Then its catalytic performances towards the hydrogen evolution reaction (HER) were evaluated. Interestingly, the catalytic performances are improved for both prepared electrodes (GC/LI/Pt, GC/LI/Pd), especially

the latest one containing palladium. It seems that the ionic layer presence displays an increase catalytic, which is probably due to the synergistic effect existence between the grafted ionic layer and the metallic nanoparticles.

**Keywords:** Ionic Liquid, Nanoparticles, Modified electrode, Electrocatalysis, Hydrogen evolution reaction.

**WEEME'24-112-Or**

## Spatial evaluation of hydrochemical facies and influence of seawater intrusion in coastal aquifer of Sebaou Valley, Eastern Algeria.

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**Abstract:** The Coastal aquifers are particularly vulnerable to saltwater intrusion. This problem has an impact on Algeria's coastal plain. Sebaou Valley, in Eastern, a simple example, it is the main valley of Kabylia drains water from Djurdjura. The present study is carried to analyze the evolution of spatial variability groundwater chemistry changes from salinity, to determine the distance of intrusion sea water in the costal aquifer. Using the spatial distribution hydrochimical data, multivariate statistical, such as principal component analysis, correlation matrix. 18 groundwater samples were collected and analyzed in the laboratory of ANRH during 2018 for major ions. Results obtained of physicochemical parameters found in order of HCO3> SO4> Cl >NO3> Ca >Mg> Na> K. Piper diagram shows that carbonate weathering is dominant process controlling the geochemistry of groundwater. Therefore, Gibbs diagram found that evaporation process and humain activity increasing salinization. The evolution of chloride contents as a function of sodium contents is not correlated (Na-Cl). However, a significant number of points are located above the right, indicating a deficit of Na+ in comparison to Cl, as sodium is attached to the seawater in contact. This suggests that sodium is a crucial component in the formation of chloride. The distribution maps of Cl and Na illustrate that the interface sea water extends over a distance of 4 km from the intrusion sea water in the coastal aquifer.

**Keywords:** intrusion sea water, salinization, multivariate statistical, Sebaou Valley.

**WEEME'24-414-Or**

## Empirical modelling of thin layer drying kinetics of mint leaves: Influence of transparent cover materials of greenhouse-type solar dryer

**Ch. Nettari[1]*, A. Benseddik[2], A. Boubekri[1], Y. Benaioua[1], H. Bensaha[2]**

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**Abstract:** Moisture content is a critical factor affecting the quality of agricultural and food products during drying. This research aimed to model and predict the moisture content of mint leaves using semi-empirical models during thin-layer drying in greenhouse-type solar dryers with different transparent cover materials: polyethylene (PEGSD) and polycarbonate (PCGSD). These covers significantly impacted the drying process, with polycarbonate exhibiting superior insulation

properties, leading to more rapid drying, while polyethylene provided more cost-effective solutions for small-scale applications. A total of ten semi-empirical models were tested to predict drying kinetics, with the "Two-Terms" and "Midilli-Kucuk" models proving the most accurate in describing the drying behavior. The drying rates varied between the two dryers, with the polycarbonate cover yielding faster moisture reduction from 87% to 11%, compared to the polyethylene cover. Effective diffusivity values during drying ranged from $9.43553\times10^{-4}$ m²/s in the polycarbonate-covered dryer to $6.76864\times10^{-4}$ m²/s in the polyethylene-covered dryer. These findings highlight the role of cover material in influencing drying efficiency, with polycarbonate showing a distinct advantage in performance and quality.

**Keywords:** Solar drying, Greenhouse, Mathematical modelling, Covering material, Mint

**WEEME'24-113-Or**

**Review of dew point evaporative system**

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**Abstract:** As technological progress advances, the demand for electrical energy has increased, with rapid demographic and urban growth promoting its overconsumption. This is particularly evident in the context of thermal comfort in residential and work spaces, as well as for industrial processes. In recent decades, with global warming and climate change, an economical and ecological air conditioning system has become essential. In Algeria, energy consumption has risen due to the use of conventional mechanical compression air conditioning systems, which consume significant amounts of electrical energy, especially during hot seasons. According to the national company SONELGAZ, each year sees a record of electricity consumption in August (over 18 GW in 2023). This study aims to investigate the different research for a passive cooling system using latent heat transformation and water to cool air, and to evaluate cooling needs during the summer period using a passive evaporative direct cooling system. The paper focuses on literature review of passive cooling techniques as an alternative to conventional air conditioning systems, which have several environmental drawbacks such as greenhouse gas emissions and the release of ozone-depleting substances. Passive cooling systems, which use natural resources such as water, can achieve good thermal comfort in summer while also saving energy through reduced consumption. This approach not only addresses the growing energy demand but also offers a more environmentally friendly alternative to traditional air conditioning methods.

**Keywords:** dew point, evaporative system, refresh

**WEEME'24-415-Or**

**Enhancement of Power Supply Reliability Based on Diversifying Energy Sources, A Multi-Objective Study in Algerian Oil and Gas Sector**

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**Abstract:** This study aims to implement a methodology that enhances the reliability of power supply for industrial loads through the integration of multiple power generation sources. The incorporation

of independent generators is crucial for achieving a high level of reliability, as industrial loads are susceptible to various aspects that can be adversely affected by power outages. This research focuses on critical aspects for petroleum facilities in Algeria, with a particular emphasis on environmental impacts. The proposed approach involves the diversification of energy sources, including renewable and conventional options, to mitigate the risks associated with reliance on a single energy source. By adopting a hybrid energy system, the study seeks to improve energy security, reduce greenhouse gas emissions, and minimize the environmental footprint of industrial operations. Additionally, the economic viability and feasibility of the proposed solutions are evaluated to prove that reliability studies have a multi-objective

**Keywords:** Power Supply, Technical Reliability, Environmental Impact, Redundancy

## Mechanics and Emerging Technologies & Materials Engineering

**WEEME'24-201-Or**

### Optimizing Queue Management with AI-Driven Wait Time Predictions in Postal Services

**Bennai Fairouz Rayane*, Boubakeur Rouabah, Benarabi Bilal, Mohamed Abdelbasset Mahboub, Kafi Mohamed redouane, Achbi Mohamed Said**

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**Abstract:** Long waiting times in queues are actually prevalent in today's society, and with people being extremely busier every day, it only adds up as a problem slowing down the turnover rate. That is why wait time estimates are an important component to address bottlenecks and prevent such inefficiencies. In this paper, a method has been developed using Machine Learning with AI for anticipation of the waiting time at post offices, utilizing advanced techniques including Random Forest, XG Boost, and Neural Networks., etc. Since actual queue data could not be retrieved, synthesized data was created with Python. Performance evaluation of all models was done, and it was observed that the Neural Network model had the lowest Mean Absolute Error (MAE) of 2. 572 and an $R^2$ of 0. 671. This points clearly to the future prospects of using AI based variants to revolutionize the queue systems in the service delivery industries leading to enhancement of service delivery to the customers.

**Keywords:** Queue systems, Wait time estimates, artificial intelligence, machine learning

**WEEME'24-306-Or**

### A comparison between the piezoelectric effect of sandstones and their thin films

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**Abstract:** Based on our previous quantative and qualitative analytical study of sandstones and their thin films, we were determined the piezoelectric effect of α-quartz for both sandstones and their thin films which prepared by hydrothermal synthesis in using sandstones as source of metallic cations as a precursor which collected from the southeast part of Algeria (Ouargla). This work enabled us to study the most important element in the Earth's crust namely quartz due to its piezoclectric properties, where the piezoelectric effect reflects to the coupling between mechanical effects and electrical effects. The piezoelectric measurements gave the strongest piezoelectric coefficients values of crystal quartz in rocks and thin films which are $d_{33}$ = 2.55 ± 0.1 pC/N for (71% of $SiO_2$), $d_{33}$ = 4.18 ± 0.1 pC/N for (69% of $SiO_2$), respectively. We were also found that the increase in quartz is supposed to increase the coefficient's value of $d_{33}$, but this does not mean that the coefficient's value of $d_{33}$ will necessarily increase due to the increase of impurities can do away with some quartz polarization. In another hand, there is a possibility that the percentage of quartz might affect the increase or decrease in the value of the piezoelectric coefficient.

**Keywords:** Sandstones, quartz, piezoelectric thin films, hydrothermal synthesis, $d_{33}$ coefficients.

**WEEME'24-204-Or**

## Modeling of the Behavior of Thermo-Mass Transfers during Successive Treatments by Hot Water Dipping and Hot Steaming of Deglet-Nour Dry Dates

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**Abstract:** This study seeks to develop a generalized equation to model the hydration of Deglet-Nour dates, enabling control and adjustment of post-harvest processing conditions. Deglet-Nour dates are Algeria's primary date variety, constituting over 50% of national production, with a high economic and commercial value. A specific type of these dates, known as "Feraza" or "Sifi," are often harvested dry due to drought conditions, resulting in an incomplete ripening state that can account for 20% to 50% of the total Deglet-Nour harvest annually. This dry harvest state result in economic losses for producers and the country, necessitating a rehydration process to recover quality. The rehydration process used involves hot water soaking and steaming in a humid environment, yet at an industrial level, it relies heavily on the operator's expertise. Hence, a reliable model would allow continuous monitoring of rehydration, enabling precise adjustments of temperature, duration, and humidity based on the dates' initial moisture content. To achieve this, an experimental and numerical study was conducted on dry Deglet-Nour dates from the Oued Righ region, with varying initial moisture levels (15% to 32%). Hydration curves were generated using Curve Expert 1.4 software, producing a linear equation for soaking at 25°C and 30°C, and a Morgan-Morgan-Finney (MMF) model for steaming at 60°C with 90% relative humidity. This model, validated across a range of moisture levels, can monitor mass gain throughout rehydration to ensure optimal quality.

**Keywords:** date, Deglet-Nour, hydration, modeling, steaming, water soaking, curve smoothing

**WEEME'24-309-Or**

**Hybrid beads synthesis for amoxicillin-controlled release**

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**Abstract:** The beads synthesis based on microcrystalline cellulose and faujasite nanoparticles was carried out with various routes. The resulting beads were characterized by infrared spectroscopy and X-ray diffraction, then investigated in controlled release of amoxicillin. The effect of pH was studied for 12.5 mg /ml, 25mg / ml,37.5 mg / ml and 50mg / ml. The amoxicillin diffusion recorded a slightly stable pace with a yield exceeding 50%, the pH effect was noted for 50 mg /ml. The hybrid beads have proven a good efficiency, these findings encourage further research to well study this diffusion while reducing the targeted drugs dose.

**Keywords:** Nano faujasite, Microcrystalline cellulose, Beads, Controlled release, Amoxicillin.

**WEEME'24-336-Or**

**Study, Design, and Manufacturing of a Burnishing Tool**

**Mourad ABDELKRIM[1, *], Abderrahim BELLOUFI[1], Imane REZGUI[1], and Mohammed Akram RAHMANI[1]**

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**Abstract:** This article presents a comprehensive study of the design and manufacturing of a burnishing tool intended for turning operations. Burnishing is a mechanical finishing process that improves surface quality and enhances the resistance of machined parts. As part of this study, a tool specifically adapted for this technique has been developed to perform burnishing operations on a lathe machine. The results show that the burnishing tool significantly improves machining performance, increases surface microhardness, and extends the lifespan of the parts, thereby reducing the need for post-machining surface treatments.

**Keywords:** Burnishing tool, design, microhardness, Cutting Parameters, Turning

**WEEME'24-316-Or**

**Energy Efficiency and Sustainable Cooling: A Parametric Study of Lithium Bromide Absorption Refrigeration Systems.**

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**Abstract:** This study explores the critical role of energy efficiency in addressing the growing global demand for sustainable energy solutions, focusing on absorption refrigeration systems utilizing lithium bromide and water as the working pair. As energy consumption continues to rise, the need for renewable and efficient energy sources becomes increasingly urgent. Absorption systems offer a viable alternative to conventional refrigeration methods, particularly when powered by solar

energy. Lithium bromide absorption systems are well-suited for applications in solar cooling, as they efficiently convert thermal energy into cooling power with minimal environmental impact. This paper investigates the operational principles of lithium bromide absorption systems and conducts a parametric analysis to assess key factors influencing system performance. By examining heat and mass transfer processes, as well as the integration of solar energy, this research highlights the potential of lithium bromide absorption systems to provide environmentally friendly, energy-efficient cooling solutions for regions with high solar insolation.

**Keywords:** energy, lithium bromide, absorption

**WEEME'24-318-Or**

**An Efficient Method for Estimating the Fractal Dimension of Color Images of Discharges on a Polluted Insulator Model**

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**Abstract:** This paper presents a novel algorithm based on fractal analysis, specifically the box-counting method (BCM), for detecting electrical discharges prior to flashover on a flat glass insulator model exposed to varying levels of uniform contamination. The process begins with the acquisition of RGB images, followed by their binarization. The fractal dimension of the resulting matrix is then calculated across multiple scales, with the final fractal dimension obtained by averaging the values computed at all resolution levels. This approach offers a robust method for analyzing the complexity and development of electrical discharges. To validate the accuracy and reliability of the algorithm, two distinct tests were conducted: one with the standard Koch snowflake and the other with the Sierpinski Arrowhead Curve. The results revealed nearly identical fractal dimensions, with a maximum relative error of 1.99% for the standard Koch snowflake and 2.55% for the Sierpinski triangle. Furthermore, an increase in fractal dimension was observed in correlation with increases in both applied voltage and the conductivity of the contaminating solution.

**Keywords:** Electrical discharges, RGB images, BCM, Fractal dimension.

# 2nd Session

## Water Management & Energy Systems

**WEEME'24-115-Or**

**Altering bentonite through acid treatment: The use of Rhodamine B in water purification.**

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**Abstract:** Natural bentonite is an adsorbent that can be easily modified to become a promising adsorbent for the removal of organic and inorganic effluents. In this present work, the natural bentonite of the M'Zila deposit (Mostaganem) was activated with sulfuric acid in order to increase the specific surface and the porosity of this material. The modifications made to the bentonite after

its activation were highlighted by BET, X-ray fluorescence as well as the cation exchange capacity. The results found showed that for a low concentration of the acid solution (1N) and at different periods of agitation of the suspension (bentonite / acid), the specific surface area increases with increasing contact time. The results of the elemental chemical analysis obtained by X-ray fluorescence showed the increase in the atomic percentage of sulfur after treatment which was initially 0.28% and that the variation in the atomic percentage of sulfur increases as well with the increase in concentration. acid only with the bentonite / acid solution contact time. In addition, the C.E.C of the four adsorbents obtained after treatment is greatly influenced by the concentration of the acid solution. Natural and treated bentonite was used for the adsorption of Rhodamine B(RhB), the effects of various experimental parameters, such as the initial adsorbent concentration, and the contact time between adsorbent and adsorbate, have been studied.

**Keywords:** Bentonite, rhodamine B, sulfuric acid, chemical activation, adsorption.

**WEEME'24-418-Or**

## Enhancing Energy Efficiency through Solar Absorption Cooling: A Numerical Analysis of key Performance Factors

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**Abstract:** The increase in global energy consumption has created an urgent need to utilize energy resources more efficiently and to harness solar energy, a non-polluting, inexhaustible, and affordable energy source. However, in real-world applications, the intermittent nature of solar energy presents a significant challenge, highlighting the necessity of energy storage solutions. Thermal energy storage (TES) plays a crucial role in enhancing the sustainability of energy use for space heating and cooling, solar energy harvesting, solar thermal generation, and other applications. In this context, solar absorption cooling emerges as a sustainable cooling technology that utilizes solar energy to power an absorption refrigeration cycle. In this system, solar collectors capture thermal energy, which heats a refrigerant-absorbent mixture in the generator, causing the refrigerant to vaporize and separate from the absorbent. The refrigerant then undergoes a cooling cycle, where it condenses and evaporates to absorb heat, providing the desired cooling effect. This energy-efficient and environmentally friendly process is particularly beneficial in regions with high solar insolation. In our study, we focused on the absorption cycle and conducted a numerical analysis to examine the impact of key factors on the performance parameters of the machine. The necessary heat and mass transfer equations, along with appropriate equations describing the properties of the working fluids, were determined. This analysis was carried out using variable operating temperatures and different values of absorption and condensation temperatures at constant pressure. The results demonstrated that increasing the generator's operating temperatures enhances the amount of stored heat, and that the optimal coefficient of performance is achieved by lowering the absorption and condensation temperatures.

**Keywords:** Energy, solar, heat, cooling, Absorption.

**WEEME'24-119-Or**

## Assessment of BOD Kinetic Parameters Using Graphical and Mathematical Methods in Wastewater

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**Abstract:** The biochemical oxygen demand (BOD) is one of the most frequently used tests to assess the strength and organic content of wastewater. This test plays a vital role in evaluating organic pollution in water and monitoring the effectiveness of wastewater treatment plants. Generally, BOD is standardized by the measurement of oxygen consumption by microorganism in the biological oxidation of organic matter in 5 days (BOD5). However, determining the ultimate biochemical oxygen demand ($BOD_u$), which takes 28 days, along with the reaction rate constant (k), is necessary for a complete assessment of the organic strength of wastewater. Several mathematical and graphical methods are available to estimate the kinetic parameters K (rate constant per day) and L (final BODu in mg/L) based on the Phelps model. However, these methods have limited general applicability, making it essential to select the most appropriate one. This research aims to determine the most precise method for estimating these kinetic parameters by evaluating the accuracy and reliability of various approaches. Wastewater samples were collected from both the inlet and outlet of the wastewater treatment plant (WWTP) in EL Oued, Algeria, with BOD values recorded over a ten-day period. Four methods were applied two graphical (Thomas and Fujimoto) and two mathematical (least squares and iteration) to calculate the final BOD value (mg/L) and rate constant (per day). The total error $Err^2$ was analyzed to identify the most accurate method for estimating BOD kinetics. Results indicated that for raw wastewater, BODu levels ranged between 312 and 724 mg/L, with rate constante of 0.1 to 0.2 $day^{-1}$. For treated wastewater, BODu values ranged from 50 to 85.39 mg/L, with rate constant of 0.05 to 0.14 $day^{-1}$. The study revealed that, based on total error analysis ($Err^2$), the least squares method proved to be highly effective in determining BOD kinetic parameters.

**Keywords:** Wastewater, BOD, ultimate BOD, rate constant, methods, least squares.

**WEEME'24-419-Or**

## Improved Energy Optimization in Hybrid Microgrids with MATLAB/Simulink-Controlled PV, Fuel Cells, and Batteries

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**Abstract:** This paper presents an advanced control strategy for enhancing the energy management system (EMS) in microgrids that integrate photovoltaic (PV) panels, fuel cells, and battery storage. The control system, developed and tested using MATLAB/Simulink, aims to optimize microgrid operations through the use of intelligent algorithms and control techniques. A key feature of the proposed system is the application of maximum power point tracking (MPPT), which ensures the efficient utilization of PV energy by continuously adjusting the operating point of the PV panels to extract maximum power. In addition, proportional-integral (PI) controllers are employed in conjunction with bidirectional DC-DC converters to manage battery charge and discharge cycles, ensuring stable and efficient battery performance. Another PI controller is used to boost the DC

voltage level, further enhancing system efficiency. The system also includes load prioritization algorithms, which distribute energy according to predefined priorities to maintain optimal performance even under varying load conditions. The proposed control strategy is thoroughly validated through simulation studies, which show significant improvements in energy management, microgrid stability, and overall performance. By leveraging the powerful modeling and simulation capabilities of MATLAB/Simulink, this study offers a practical solution to the challenges of energy management in microgrids that integrate multiple renewable energy sources. The simulation results demonstrate that the advanced control system can effectively balance supply and demand, improve energy utilization, and contribute to the stability of the grid, making it a robust and efficient approach for modern microgrids.

**Keywords:** Renewable Energy, Photovoltaic (PV) system, Fuel cell system, Battery energy storage system, Maximum Power Point Tracking (MPPT), energy management system.

**WEEME'24-124-Or**

**Preparation and validation of metallic electrodes used in electrolysis of water**

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**Abstract:** The development of metallic catalysts used in water electrolysis is a very remarkable field in the last years, because of their importance in the production of hydrogen; which presents a widely used fuel; especially in energy and automobiles industries. The classical way recognized is its production of water electrolysis by the use of very noble metals namely: gold and platinum, which have the disadvantage of their very high cost. Therefore; the search for less expensive electrode materials is a very exploitable domain. Among these alternative materials, we find catalysts in cheaper noble metals, non-noble metals, metal alloys and alloys doped with other materials, … etc. The preparation method of these materials remains a great challenge because of the multitude of experimental parameters. In this work, we contributed by the preparation of some metallic catalysts by studying the effect of experimental parameters. We synthesized Mn-on-Fe, Mn-on-Cu, Mn/Ni-on-Ni, and Mn/Fe-on-steel electrodes by electrodeposition, considering the following parameters: pH, deposition potential, concentrations of products and improvement additives. We also prepared $Cu/TiO_2$ and $Ag/TiO_2$ electrodes by metallurgy and by surface heat treatment of $C/TiO_2$, $Cu/TiO_2$, and $Ag/TiO_2$ electrode materials. We examined their $H_2$ production efficiency by the NaCl solution (10%) electrolysis process; hence, they showed a difference of about 15 to 20 % in $H_2$ production, compared with the base electrode materials of each tested material.

**Keywords:** Electrodeposition, Metallic catalysts, Water electrolysis, Carbone, $TiO_2$.

## Mechanics and Emerging Technologies & Materials Engineering

**WEEME'24-320-Or**

**Impact of Cutting Parameters on Surface Quality in Face Milling of X2CrNi18-9 Stainless Steel: Insights from Response Surface Methodology and Genetic Algorithms**

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**Abstract:** When machining, it is important to keep production cleanliness and cutting quality in mind. Identifying the most efficient cutting settings is crucial for attaining the best outcomes. This not only reduces energy usage but also improves surface quality. This study performed tests on X2CrNi18-9 stainless steel using coated carbide inserts (GC4040) using the face milling process. The study seeks to assess and compare the output data, specifically the surface roughness (Ra). The aim is to evaluate the influence of cutting factors, such as cutting speed (Vc), feed per tooth (Fz), and depth of cut (ap), on this output parameter. The analysis will be performed via response surface methodology (RMS) combined with analysis of variance (ANOVA), followed by modeling through the application of a genetic algorithm (GA). The results indicate that the amount of feed per tooth is the main determinant of surface roughness (Ra), explaining 57.84% of the total impact. The cutting speed is the second most significant factor, contributing 17%.

**Keywords:** stainless steel, coated carbide, face milling machining, cutting parameters, RMS, ANOVA, GA.

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**WEEME'24-323-Or**

**Perovskite Solar Cells: The Way in the Future of Efficient and Accostable Solar Energy Title**

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**Abstract:** This study explores the advancements and challenges of perovskite solar cells (PSCs) within the expanding solar technology landscape and their potential as sustainable energy sources. Notable improvements in photovoltaic efficiency and cost reductions have driven global solar installations, with PSCs achieving high power conversion efficiency (PCE). The research highlights the evolution of PSCs from unstable liquid forms to reliable solid-state designs with efficiencies over 20%. Using SCAPS-1D modeling, the study evaluates key structural and material characteristics affecting PSC performance, such as layer thickness and electron affinity. The results underscore the importance of electron transport distance in enhancing charge collection and reducing recombination losses, thereby increasing PCE. Current-voltage simulations demonstrate strong carrier production and transport capabilities, revealing excellent performance without saturation at higher voltages, indicating low series resistance. The study concludes by emphasizing the need to optimize electron mobility, layer quality, and device architecture for improved PSC efficiency, stability, and scalability.

**Keywords:** Photovoltaic Cells, Perovskite Solar Cells, Materials, Sustainable Energy, Affordable Solar Energy.

**WEEME'24-328-Or**

## Carbon nanotubes characterization and their potential for increased hydrocarbon production

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**Abstract:** L'augmentation du taux de récupération des hydrocarbures est l'un des objectifs les plus importants dans le domaine des hydrocarbures. L'élimination des problèmes qui obstruent l'écoulement, tels que les sulfates ou les dépôts de sulfate de baryum, va augmenter la récupération des hydrocarbures. Dans ce travail, on utilise les nanotubes de carbone pour résoudre le problème de sulfate. Afin d'éviter la précipitation de sulfate de baryum. Les nanotubes de carbone multi parois (MWCNT) multiwalled carbon nanotubes ont été préparés par dépôt chimique en phase vapeur de gaz de condensation à 1000 °C et oxydés avec un mélange acide à 115 °C pendant 2 h, puis appliqués comme adsorbant pour l'élimination des sulfates. Les variables Effets tels que la température, la dose d'adsorbant, le temps et la vitesse d'agitation, ainsi que leurs interactions pendant l'adsorption ont été déterminés et optimisés par la méthodologie de surface de réponse (RSM) via un plan factoriel composite central (CCF). Les données expérimentales ont été examinées par analyse de variance (ANOVA) et ajustées à une équation polynomiale du second ordre. Les conditions optimales étaient une concentration initiale de 800 mg/L, une dose d'adsorbant de 0,14447 g, un pH de 7 et une température de 74,21 °C, 530 tr/min pendant 240 min, et une élimination maximale des sulfates de 96 % a été obtenue. Des modèles d'isothermes ont été étudiés pour décrire les données d'adsorption des sulfates et un modèle plus élevé adapté à l'isotherme de Langmuir a été trouvé. Des études cinétiques ont montré que l'adsorption suivait une réaction de pseudo second ordre. Dans l'ensemble, les MWCNT sont des adsorbants prometteurs pour le traitement de l'eau et ont un grand potentiel d'application dans les champs pétrolifères pour réduire la teneur en ions de tartre à la source.

**Keywords:** adsorption, ion sulfate, nanotubes de carbone, taux récupération, élimination des dépôts.

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**WEEME'24-331-Or**

## Efficient Eddy Current Detection of 3D Cracks Through Probe Signal analysis

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**Abstract**: The study of 3D eddy current is non destructive testing system for cracks characterization using finite element method requires a great amount of computing time and memory space. In this article, we have validated the developed model and then determined directly the crack length by analyzing the complete signal. Afterwards, we have extracted from the complete sensor sweep signal the maximal amplitude that we have exploited to estimate the crack depth.

**Keyword:** Eddy Current Sensor; Crack characterization; 3D finite elements; Simplified Signal.

# 3rd Session

## Water Management & Energy Systems

**WEEME'24-425-Or**

### A GIS-Driven Multi-Criteria Decision-Making Framework for Wind Energy Site Selection in Algeria

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**Abstract:** The increasing global demand for energy, along with concerns about resource depletion and climate change, underscores the urgent need for sustainable energy solutions, particularly wind power. Wind energy offers a viable alternative to reduce greenhouse gas emissions and enhance energy security. This study aims to identify optimal locations for wind energy development in Algeria by integrating the Analytic Hierarchy Process (AHP) with Geographic Information Systems (GIS). Using ArcGIS Pro software, the suitability of various areas for wind energy production was assessed and categorized into five classes: "very low suitability," "low suitability," "moderate suitability," "high suitability," and "very high suitability." The findings indicate that 1.14% (27,136 km²) of the study area is classified as very low suitability, 0.06% (1,408 km²) as low suitability, 1.98% (47,178 km²) as moderate suitability, 14.6% (348,416 km²) as high suitability, and 4.22% (100,672 km²) as very high suitability for wind energy projects. The remaining 77.98% (1,856,931 km²) of the area was deemed unsuitable. A sensitivity analysis was conducted to assess the robustness of the model under different scenarios, providing valuable insights for decision-makers and stakeholders in sustainable energy planning.

**Keywords:** GIS; MCDM; AHP; Wind Energy; Site selection; Algeria.

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**WEEME'24-426-Or**

### Impact of bypass diodes on Mismatch Induced Partial Shading in Solar Panels

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**Abstract**: Partial shading is a prevalent issue in photovoltaic (PV) systems, occurring when different modules within the array receive varying levels of irradiance due to obstructions such as nearby buildings, trees, or other objects. This phenomenon can substantially diminish the overall performance of the system. This study aims to examine the effects of partial shading with the bypass diode and without bypass on the performance and efficiency of PV arrays. To this end, simulation models are employed to assess the performance of PV array configurations under various shading conditions. MATLAB is utilized to conduct the simulations and present the results.

**Keywords**: Partial Shading, MATLAB, Bypass diode, PV arrays, Performance and efficiency of PV arrays

**WEEME'24-427-Or**

## Measuring and Predicting the Ground Temperature at Different Depths in Saharan Algeria Region: Application to Underground Buildings

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**Abstract:** The ground temperature constitutes essential data for the design and construction of different geothermal projects. To examine whether underground construction offers a good source of cooling in a hot climate, vertical ground temperatures were predicted using Kusuda formula using the climate conditions of Ouargla city situated in the northeast of Algerian Sahara. Experimental validation of the developed model is presented in this paper. The validation yielded a Mean Absolute Error (MAE) of ≤ 0.12 °C and a Root Mean Square Error (RMSE) of ≤ 0.15 °C. Simulation results show that the temperature stabilizes around 27 °C at a depth of 5 m. In addition, TRNSYS simulation results of underground building temperature at different depths are presented. The findings showed that the underground building at a depth of 3 m minimizes significantly the air conditioning demand in the summer period. As a result, underground buildings offer real opportunities to reduce the cooling loads and provide thermal comfort in summer in hot climates.

**Keywords:** Ground temperature, Underground building, Experimental measurement, Simulation results

**WEEME'24-429-Or**

## Techno-economic analysis of standalone microgrid photovoltaic-wind hybrid system with battery storage: case study in Ngoussa, Ouargla

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**Abstract**: This article studies the techno-economic feasibility, and the exploitation of green energy resources, for the production of electricity for a health clinic in rural and saharan areas, located in a desert oasis in Ngoussa, Ouargla, in southern Algeria. using the HOMER energy micro-grid software, we optimize with a techno-economic evaluation of a photovoltaic and Wind hybrid system with electrical storage in electric batteries, for a proposed load profile we have determined and minimized the costs of electricity supply, with an optimal sizing of an electrical architecture of the photovoltaic and wind hybrid system. thus, we have estimated the life cycle of the hybrid system, the energy cost of a kilowatt-hour (1$/kwh), taking into account a more in-depth understanding of the cost and the need for electricity in isolated places of immense desert.

**Keywords**: Micro-grid, hybrid system, electric batteries

**WEEME'24-431-Or**

**An improved metaheuristic algorithm for parameter extraction of triple-diode photovoltaic cells model**

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**Abstract:** Several solar cell technologies have emerged recently characterized by their exceptional photovoltaic (PV) performance and cost-effectiveness. Precisely estimating the parameters within PV solar cell models remains a crucial focus within this field of research. This article introduces a novel technique called the Mutated Firefly Algorithm (Mu-FA) with the aim of accurately determining the parameters of PV solar cell models, particularly those represented in the triple-diode model (TDM). This approach integrates experimental data with optimization methods to achieve its objectives. The fitness function employed for optimization is the Root Mean Square Error (RMSE), which quantifies the disparity between estimated values and experimental data. Moreover, the use of the Lambert W function in the calculation of the explicit electrical PV cell outputs improves the accuracy of the obtained results. Comparative evaluations with other metaheuristic techniques highlight the effectiveness of Mu-FA, demonstrating its efficiency, robustness, and reliability. These findings establish Mu-FA as a promising tool for the precise assessment of parameters in thin film solar cell models within the realm of academic research.

**Keywords:** Metaheuristic, Thin film, Optimization, Mutated Firefly algorithm, parameter extraction, Triple- diode model, Photovoltaic cells

## Mechanics and Emerging Technologies & Materials Engineering

**WEEME'24-205-Or**

**Numerical study of forced convection in a channel using a nanofluid**

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**Abstract:** In this work, a numerical study was carried out of forced convection in a channel containing two substrates in parallel on which eight heat sources simulating electronic components have been placed in the presence of a nanofluid. The flow is laminar in steady state and the fluid is assumed incompressible and Newtonian. The simulations were carried out using the FLUENT calculation code and the governing equations (continuity, momentum and energy equations) were solved using the finite volume method and the SIMPLE algorithm for coupling (pressure-velocity). Simulations were carried out for different Reynolds numbers (10, 50, 100 and 500) and for different volume fractions (0.01, 0.02, 0.03, 0.04 and 0.2). Analysis of the dynamic field (current function and evolution of the velocity profile) and the thermal field (isotherm contours and evolution of the temperature profile and Nusselt number) shows that heat transfer improves remarkably with increasing Reynolds number and volume fraction.

**Keywords:** forced convection, heat transfer, nanofluid, substrates, finite volume method.

**WEEME'24-339-Or**

## Predicting Material Properties from Dynamic Displacement Responses Using Numerical Modeling

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**Abstract:** Dynamic displacement responses are analyzed in this paper to present a novel approach to predicting material properties. It is important to understand material properties like stiffness, elasticity, and damping. Property determination traditionally involves complex and time-consuming mechanical testing, which may not be feasible in every context. Dynamic displacement data obtained from controlled loadings is utilized to infer key material characteristics, significantly simplifying the process. The proposed method utilizes a combination of numerical modeling and machine learning to relate displacement behavior under dynamic loads to underlying material properties. We develop predictive models that identify material attributes from displacement profiles alone by inverse method. This approach not only accelerates property prediction but also reduces the need for invasive testing, making it ideal for rapid assessments in real-world applications.

**Keyword:** Structural dynamics, Material properties, Prediction, Numerical methods, Displacement

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**WEEME'24-340-Or**

## Optimizing CuGaSe2 Absorber Layers for Enhanced Efficiency in Perovskite Solar Cells: A SCAPS-1D Simulation Study

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**Abstract:** This study explores the enhancement of perovskite solar cell (PSC) efficiency by integrating copper gallium diselenide $CuGaSe_2$ (CGS) absorber layer with a formamidinium lead iodide ($FAPbI_3$) perovskite layer. Using SCAPS-1D simulations, we investigate how variations in CGS absorber layer thickness, acceptor and defect densities, series and shunt resistances, and operating temperature affect photovoltaic parameters such as open-circuit voltage ($V_{OC}$), short-circuit current density ($J_{SC}$), fill factor (FF), and power conversion efficiency (η). Our findings demonstrate that increasing the absorber layer thickness significantly boosts both the open-circuit voltage ($V_{OC}$) and short-circuit current density ($J_{SC}$), resulting in improved overall efficiency. A higher acceptor density within the absorber layer notably raises $V_{OC}$ and power conversion efficiency, indicating enhanced p-type conductivity and reduced recombination losses. Additionally, minimizing defect densities was found to be critical in reducing recombination losses, leading to better charge carrier mobility. Optimization of series and shunt resistances was essential in minimizing power losses, with low series resistance and high shunt resistance contributing to higher fill factors. However, elevated temperatures were found to negatively impact $V_{OC}$ and FF, thereby reducing overall efficiency. These insights highlight the importance of absorber layer optimization, defect management, and thermal control in

maximizing the efficiency of $FAPbI_3$/CGS heterojunction solar cells, contributing to advancements in PSC technology.

**Keywords:** Perovskite solar cell, Power conversion efficiency, Fill factor, Absorber layer optimization.

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**WEEME'24-342-Or**

## Advanced Predictive Modeling for Optimizing Electrical Discharge Machining (EDM) Parameters

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**Abstract:** This research focuses on analyzing the impact of machining parameters on the efficiency of electrical discharge machining (EDM). It stands out through the development and implementation of an innovative experimental methodology to evaluate the performance of this process. A key contribution lies in the creation of an advanced predictive model capable of thoroughly analyzing the influence of various machining parameters on EDM performance. The results achieved demonstrate exceptional accuracy, with an average deviation from experimental values not exceeding 5%, significantly enhancing the reliability and validity of the model. The precise prediction of machining conditions is of critical importance to the industrial sector, as it enables process optimization, cost reduction, and consistent quality assurance. By making EDM more efficient and predictable, this research directly contributes to improving its competitiveness and sustainability across various industrial applications.

**Keywords:** Electrical Discharge Machining (EDM), Predictive Modeling, Machining Parameters Optimization, Industrial Efficiency, Performance Evaluation

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**WEEME'24-346-Or**

## Estimation of thermophysical properties of a solid plate using inverse heat conduction problem

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**Abstract:** The aim of this academic communication is the implementation of inverse techniques in order to estimate the thermal properties that may be difficult to measure or assess. To estimate properties such as density, specific heat, thermal conductivity and thermal diffusivity, the method of Levenberg-Marquardt for parameter identification is used, a numerical simulation is realized based on this algorithm for this purpose. To validate this program, numerical simulations on a solid plate of given thickness and known properties are used. The results given by the numerical simulation of the direct problem allow us to calculate the transient temperature fields through the plate where the temperature sensors are located, the location of the temperature sensors, and the

duration time of the experiment is chosen basing of the sensitivity study of the problem. The temperature fields are used as temperature measures, then the thermophysical properties are estimated. To make this problem more realistic the simulated temperature fields are perturbed by a random error to make the temperature profile like real temperature measurements, then they are used another time to estimate the thermophysical properties. The results obtained for the exact temperature fields are exacts however, for the perturbed temperature fields a small deviation from the exact values are noticed, but the result remains excellent.

**Keywords:** Inverse Methods, inverse heat conduction, finite difference, Levenberg-Maquardt Method, parameters identification

# Poster Communications Abstracts

## 1st Session

## Water Management & Energy Systems

**WEEME'24-108-Ps**

**Water quality of the groundwater aquifer: case city El Oued.**

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**Abstract:** In a rapidly changing socio-economic context marked by difficult climatic conditions, water remains crucial for developing human activities in the Sahara. Although the quantity of water is generally sufficient thanks to the vast underground resources, particularly in the Northern Sahara, the quality of water intended for human consumption could be better, particularly in the Souf region. Groundwater from different aquifers often has high salinity due to geological factors and poor resource management. The mineralization of the water varies, sometimes reaching levels that make it unfit for consumption. In addition, anthropogenic pollution aggravates the situation, making it necessary to pre-treat the water before its distribution. The mineralization of the water varies between 1 and 2 g/l of dry residue and can reach 5 g/l. The waters of the Albian and Pontian boreholes are particularly hard and mineralized, with high levels of loaded with chlorides (Cl-), sulfates (So4--), calcium (Ca++), Manganese (Mg++), bicarbonates (HCO3-), often exceeding the standards for portability. The difference between the two resources is also due, on the one hand, to the temperature of 60°C at the wellhead for the Albian and 30°C for the Pontian, on the other hand, to the mineralization and 1.6 g/l for the Albian and 2.1 g/l for the Pontian and the company a very high electrical conductivity. It is imperative to treat drinking water or find alternative sources to ensure a supply that meets health standards. This study highlights the need for continued research and investment to ensure safe drinking water in the city of El Oued.

**Keywords:** water quality, El Oued, CT aquifer, CI aquifer.

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**WEEME'24-109-Ps**

**Effect of Water quality on Chemical Formulation: Application in Enhanced Oil Recovery**

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**Abstract:** This study presents the results of phase behavior during the injection of surfactants, emphasizing the formation of microemulsions in a context where two types of water are used as the aqueous phase: the first case involves ultra-pure water, and the second case uses mineral-rich water. The tests conducted allowed for an analysis of how surfactants interact with both types of water and

oil, thereby promoting the formation of microemulsions. Experiments show that the use of ultra-pure water facilitates the formation of microemulsions during the injection of this type of surfactant, due to their ability to reduce interfacial tension. In contrast, when mineral-rich water is used, it is observed that microemulsion formation does not occur.

**Keywords:** phase behavior, surfactants, microemulsions, ultra-pure water, mineral-rich water, interfacial tension.

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**WEEME'24-104-Ps**

**Green synthesis of carbon dots from date seeds: application**

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**Abstract:** In one step hydrothermal treatment of date seeds an easy low-cost and green assay to synthesis a Carbon Dots with an excellent proprieties such as low toxicity physio-chemical stability and outstanding biocompatibility CDs have a wide range of application such as catalysis sensor drug delivery biological imaging and other fields herein using a hydrothermal treatment of date seeds is achieved in synthesis of carbon dots which will be applied as a selective sensor for one of this metals Ni, Fe, Cu, Mg, Co, Al, Pb, Hg, Zn, Cd. The prepared CDs will be subjected to various characterization techniques, including X-ray diffraction, Photoluminescence Ultraviolet visible spectroscopy transmission electron microscopy and Fourier-transform infrared spectroscopy to verify the formation of carbon dots and their surface functional groups finally we will investigate the detection of ion metal in a real water sample

**Keywords:** nanoparticules, carbon dots, green synthesis, wastewater treatment

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**WEEME'24-105-Ps**

**Analysis of water quality for agricultural use in the Adrar region**

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**Abstract:** The Adrar region in southern Algeria is home to the largest groundwater reserve in the Algerian Sahara. The aim of the present work is to assess the quality of groundwater in the Intercalary Continental (IC) and to detect salinity in the Adrar region. The results show that these waters are highly mineralized and excessively hard, with high chloride, sulfate and sodium contents. They generally present a high risk of salinization for soils, and to carry out this study, eighteen (18) water samples were taken, the parameters measured and analyzed being pH, EC, TDS, Na+, K+, $Ca^{2+,}$ $Mg^{2+,}$ $Cl^{-}$, $SO4_{2-,}$ NO3- and $HCO_{3-.}$ The hydro-chemical study shows that CI waters are dominated by two types of facies: chloride-sodium 83.33% and sulfate-sodium 16.67%. Water potability was assessed by comparing physicochemical parameters and major ions with Algerian potability standards. 55.55% of boreholes sampled were within acceptable limits for drinking water, with reference to Algerian potability standards, while 44.45% of boreholes sampled failed to meet potability standards. Irrigation water quality was assessed using potential irrigation water quality factors: electrical conductivity (EC), sodium adsorption ratio (SAR), sodium percentage (%Na), Kelly

ratio (RK), permeability index (PI), magnesium hazard (MR), residual sodium carbonate (RSC) and chloride content. The study of these parameters shows that CI water quality is admissible in the majority of boreholes analyzed.

**Key words:** Adrar, Intercalary Continental, AEP, irrigation, SAR.

**WEEME'24-106-Ps**

## The Origin of groundwater mineralization in the Adrar region (Algerian Sahara)

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**Abstract:** Groundwater plays a crucial role in sustainable development and the supply of drinking water in the Sahara regions. A study was carried out to assess the domestic water quality and hydrogeochemical characteristics of the Continental Intercalaire (CI) aquifer in Adrar. Twenty-five (25) water samples were collected from wells in the CI aquifer. Parameters measured and analyzed included pH, electrical conductivity (EC), total dissolved solids (TDS), sodium, potassium, calcium, magnesium, chloride, sulfate, nitrate, and bicarbonate. Water potability was assessed by applying the Water Quality Index (WQI), assigning a unique score to each sample. The results show that water from the CI aquifer falls into two quality categories: good (28%) and poor (72%). In addition, Piper diagram analysis classified the groundwater into two types, namely Ca-Mg-SO4-Cl and Na-Cl, indicating that these waters are influenced by evaporite dissolution and the effect of evaporation under the arid climate.

**Key words**: Adrar, intercalary continental, potability, Piper, WQI.

**WEEME'24-107-Ps**

## Saving Bechar's Future: The Impact of Climate Change and Strategic Water Resources Management through Water Quality Assessment

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**Abstract:** The onset of the issue in the field of drinking water delivery to the profile of Bechar residents in 2018, undoubtedly influenced by climate change, as indicated by the drought of surface water and low groundwater levels. In this environment, and to terminate the population's reliance on water from the Djorf Torba Dam, the Ministry of Water Resources has approved an emergency program for ten drilling projects in Boussir. This scheme is a way to provide drinking water to the residents of Bechar. Ten 550-meter-deep wells generate a total flow of 25,000 to 30,000 cubic meters per day of high-quality water. The quality of drinking water was examined from extraction in the Boussir field to distribution in Bechar using WHO and national criteria, and studies revealed that the water met quality standards while containing no harmful microorganisms. Climate change poses the most significant problems to the region's water resource management. However, we want to enhance the distribution network to prevent losses, maintain fair distribution and constant monitoring of water quality, and strive to mitigate the effects of climate change in order to ensure the sustainability of water resources. In this study, we hope to get a better understanding of the

quality of drinking water and contribute to the issues of managing water resources in an arid climate, as well as provide solutions for the long-term use of this critical resource for public health and economic growth.

**Keywords:** Bechar, Boussir, drinking water, quality water, water resource management, groundwater

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**WEEME'24-110-Ps**

## Investigation of the relationship between dewatering and solids residence time imposed in biological reactors

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**Abstract:** Several parameters influence dewatering efficiency, such as the dewatering technique applied, the nature and composition of the sludge, above all, the conditioning techniques used. This study aims to investigate the effect of solid residence time on the dewatering of a biomass recovered from two 01L capacity biological reactors operating at different sludge ages of 03 and 25 days and a hydraulic residence time of 1.6 days. The reactors are fed with a binary substrate composed of glucose at a COD of 400 mg/L and ammoniacal nitrogen with a C/N ratio of 19.04**.** The efficiency of centrifugal dewatering of the various activated sludge (AS) recovered from the reactors after 02 hours thickening was assessed by estimating the solid cake, while quantifying the capillary suction time (CST), the mineralization rate, the quantity of proteins and polysaccharides constituting the exocellular polymers (EPS), as well as the activity and morphological presentation of the aggregates assessed by the respirometric technique in continuous aeration. It was noted that dewatering is largely influenced by the imposed sludge ages, which condition not only their composition and activity, but also their morphological presentation. Solid cake percentages ranged from 10.21to 40.83% for sludge ages of 3 to 25 days respectively.

**Keywords:** Dehydration, solids residence time, Centrifugation, Solid cake, Microbial activity

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**WEEME'24-111-Ps**

## Examination of Experimental Data and Breakthrough Curves for Hexavalent Chromium Biosorption Using Eucalyptus Chips in a Fixed-Bed Column

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**Abstract:** This study examined using biomass from eucalyptus chips in a fixed-bed column to remove Cr(VI) from aqueous solutions. Through experimental trials, a number of important design parameters, including bed depth (10–15 cm), flow rate (5–20 mL/min), and inlet concentration (30–50 mg/L), were investigated. 15 cm of bed depth, 10 mL/min of flow rate, and 50 mg/L of intake concentration were found to be the ideal parameters. Additionally, the experimental data was

analyzed and breakthrough curves under various operating conditions were predicted using the BDST, Thomas, and Adams–Bohart models. The BDST model demonstrated strong agreement with the experimental findings. The Adams-Bohart model worked well for the first stage of biosorption, but the Thomas model (R2 > 0.97) appropriately reflected breakthrough curves. Three cycles of biosorption regeneration were conducted using the biosorbent after washing Cr(VI) with 0.05 M HNO3 to renew the column. The results showed noteworthy Cr(VI) elimination and effective regeneration, however there was a small decrease in biosorption capacity across cycles. In fixed-bed column applications, eucalyptus chip biomass has emerged as a viable biosorbent for the removal of Cr(VI).

**Keywords:** Eucalyptus chips, Hexavalent chromium, Biosorption; Modeling; Fixed-bed column

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**WEEME'24-114-Ps**

### Enhancing Solar Desalination Efficiency Through Intermittent Water Supply: A Case Study in Arid Oases Regions

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**Abstract:** The increasing demand for renewable and clean energy sources has spurred growing interest in solar energy applications, particularly in arid regions where water scarcity poses significant challenges. This study investigates the potential of solar energy for desalinating salty water in the oases area, aiming to provide a sustainable and cost-effective solution for agricultural and animal irrigation. Two simple, identical solar stills were designed with dimensions of 1m x 1m and an inclination angle of 15 degrees. The first solar still was filled with 12 liters of salty water, while the second was initially filled with 5 liters and supplemented with 1 liter every hour over a seven-hour period. The experiment, conducted at the Higher School of Teachers in Ouargla, showed that the second solar still achieved a productivity of 3.5 liters, compared to 1.8 liters for the first, representing a 94% increase. Moreover, the first solar still exhibited an efficiency of 21%, while the second achieved 42.86%. These results indicate that intermittent water supply can substantially boost solar still productivity, offering a practical and efficient method for enhancing water resources in agriculture, particularly in the water-scarce regions of the world.

**Keywords:** Desalination, Water treatment, Water productivity, Solar stills.

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**WEEME'24-116-Ps**

### Adsorption Study of Methylene Blue Dye On leaves of Phragmites australis

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**Abstract:** This research focuses on developing a cost-effective green biosorbent from the leaves of Phragmites australis (LPA) to eliminate blue methylene from aqueous solutions in batch experiments. The effectiveness of the adsorbent was assessed under various conditions by altering parameters such as adsorbent dosage, pH, contact time, temperature, and initial blue methylene concentration. The adsorption parameters were determined using the Langmuir, Freundlich, and

Temkin isotherms based on the collected data. The maximum adsorption capacity for LPA was found to be 30.98 mg/g. The data were best represented by the Langmuir adsorption isotherm at equilibrium, with an $R^2$ value of 0.994. Additionally, a kinetic analysis was conducted using pseudo-first-order and pseudo-second-order kinetic models, revealing that the adsorption of blue methylene on the chosen biosorbent adheres to pseudo-second-order kinetics ($R^2$ = 0.999). These results indicate that blue methylene can be effectively removed from aqueous solutions using a biosorbent derived from the raw biomass of Phragmites australis leaves.

**Keywords:** Phragmites australis, Methylene blue, Kinetics, adsorption isotherm

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**WEEME'24-117-Ps**

## Synthesis, Characterization, Antimicrobial activity. and Molecular Docking Studies of N-acetyl-para-aminophenol-Nanoparticles

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**Abstract:** Nanotechnology refers to the creation and utilization of materials whose constituents exist at the nanoscale; and, by convention, be up to 100 nm in size. Nanotechnology explores electrical, optical, and magnetic activity as well as structural behavior at the molecular and submolecular level. It has the potential to revolutionize a series of medical and biotechnology tools and procedures so that they are portable, cheaper, safer, and easier to administer. Nanoparticles are being used fordiverse purposes, from medical treatments, using in various branches of industry production such as solar and oxide fuel batteries for energy storage. This study aims to synthesize nanoparticles using N-acetyl-para-aminophenol and evaluate their efficacy against Escherichia coli cells through molecular docking. Pure N-acetyl-para-aminophenol was extracted from commercial N-acetyl-paraaminophenol using centrifugation, and the formation of nanoparticles was confirmed through color changes and UV spectroscopy. Molecular docking simulations between acetaminophen and E. coli were performed using the AutoDock software. The results indicated the formation of weak bonds between the molecules, suggesting low efficacy of acetaminophen against the bacterial cells.

**Keywords:** MnO- N-acetyl-para-aminophenol, Chemical precipitation method, Escherichia coli Staphylococcus, drug

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**WEEME'24-118-Ps**

## Assessment of the physicochemical water quality in Miocene springs of the southeastern Upper Cheliff Plain, Algeria

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**Abstract:** Drinking water must follow strict standards of physicochemical, microbiological, and organoleptic quality. The increasing demand for freshwater resources, driven by population growth and different uses, has delicate the importance of securing reliable sources of clean water.

Groundwater, known for its high quality, has become a crucial resource for drinking water supplies. The availability and sustainable management of groundwater are vital in shaping patterns of population settlement and in driving economic activities across various sectors. Groundwater sources, such as wells and springs, serve as the primary reservoirs for potable water, as well as for agricultural and industrial irrigation. However, these essential resources are under continuous threat from pollution, originating from agricultural runoff, industrial discharges, and residential waste. Protecting groundwater from contamination is imperative to ensure its long-term availability and to maintain the quality necessary for human consumption and economic use. In this study, conducted in 2020, water samples were carefully collected from a few springs located in the Miocene aquifer, located in the southeastern region of the Haut Chéliff plain in Algeria, in the communes of Djendel, Ain Lechiekh and Oued Chorfa. The results obtained indicate a significant variation in water properties, including temperature (ranging from 16.4°C to 25.7°C), electrical conductivity (from 1,155 to 3,550 µS/cm), turbidity (from 0.24 to 9.4 NTU), pH (from 6.88 to 7.1), and total hardness (from 42 to 123 °F). Other chemical elements analyzed exceed Algerian standards, including calcium and magnesium, making the water hard to very hard, as well as high levels of chlorides, sulfates, nitrates, and bicarbonates. The hydrogeochemical analysis identifies three main chemical facies: calcium and magnesium chloride and sulfate facies, magnesium chloride facies, and calcium and magnesium bicarbonate facies. This study highlights the crucial importance of monitoring and protecting these water resources to ensure food security and public health in the region studied.

**Keywords:** Water resources, Hydrochemical facies, Water quality, Upper Cheliff Plain

**WEEME'24-120-Ps**

## Impact of climate variability on land occupation. The case of Wadi Fekan (NW Algeria)

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**Abstract:** Climatic drought threatens natural resources of Mediterranean regions, particularly in northwestern Algeria. This study highlights the impact of drought by analyzing its spatio-temporal evolution and its influence on land use in Wadi Fekan watershed. Rainfall data over four decades from eleven stations were criticized, homogenized and filled to ensure their reliability. Standardized precipitation and climatic humidity indices allowed detecting the period of rainfall regime break and calculating the rainfall deficit or surplus along with the temporal climate change degree. The data were spatially represented to illustrate the evolution of the phenomenon. Break detection tests, i.e. Lee and Heghinian, Pettitt, and Hubert segmentation tests, validated the results. The evolution of land use were also analyzed. The findings showed rainfall breaks between 1999 and 2006, with 31.7% rainfall increase over the last two decades, leading to a runoff increase and 0.045% spatial change in the Wadi class occupation compared to 1983-1993. The spatial evolution of statistical indices shows that aridity is more marked towards the center of the region due to the Foehn effect. Finally, this study highlighted the need to adopt sustainable water resource management strategies

in the face of these changing climatic conditions in order to avoid possible future water crises in the region.

**Keywords:** Algeria, Fekan, Drought, Land use

**WEEME'24-121-Ps**

## Decontamination of water polluted by toxic heavy metals (Mercury and Lead) using a low-cost and environmentally-friendly bioadsorbent

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**Abstract:** Mercury and lead are highly toxic, and can cause cancer and damage to the immune and reproductive systems. The impact depends on their bioavailability and their ability to enter the food chain. For this reason, the elimination of these heavy metals from industrial wastewater has been recognized as an environmental problem, due to their carcinogenic toxicity even at low concentrations. The aim of this study was to eliminate these toxic heavy metals using a low-cost bioadsorbent (Acacia saligna leaf). Acacia saligna (Mimosa) is extremely abundant throughout the year in the town of Mostaganem (city of Mimosa), located in north-western Algeria. The characterization of Acacia saligna leaves (LAS) was determined by DRX, SEM and FTIR. The study showed the significant role of cellulose, hemicellulose, and lignin,which are rich in functional groups such as –OH, –COOH, and $–NH_2$, in the adsorption mechanism, enabling the effective binding of $Hg^{+2}$ and $Pb^{+2}$. The adsorption capacity of this new biosorbent to remove $Hg^{+2}$ and $Pb^{+2}$ was studied under the following operating conditions: bioadsorbent mass, equilibrium time, initial dye concentration and pH. The maximum adsorption rate was obtained for a pH of 6.5, a biosorbent dosage of 0.4 and 0.5 g/L for Hg and Pb successively, and a contact time of 4 hours. The maximum adsorption capacity 51.23 and 17.13 mg/g for Hg and Pb successively was found using the Langmuir model. In accordance with the qmax value, the bioadsorbent removed heavy metals in the order: $Hg^{+2}$> $Pb^{+2}$. The study of sorption kinetics indicated that the second-order kinetic model could best illustrate the adsorption mechanism ($R^2$ =1). The results showed that LAS (MIMOSA leaves) is a readily available and highly effective biosorbent for the removal of toxic heavy metals from wastewater.

**Keywords:** Depollution, Heavy metals, Bioadsorption, Acacia saligna leaf, Adsorption kinetics

**WEEME'24-122-Ps**

## Calculation of irrigation dose using climatic data available to the farmer

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**Abstract:** Touggourt region, with an aridity index of 1.75, faces significant challenges in sustaining

agriculture due to its arid climate and sandy soil. Year-round irrigation is crucial for crop survival but requires careful management given the severe conditions. The study aims to establish a relationship between Class A evaporation pan data and evapotranspiration, a key factor in determining irrigation requirements. A model will be developed using these climatic parameters. The developed model demonstrated a strong linear relationship between reference evapotranspiration and Class A evaporation pan data, with a high correlation coefficient (R = 0.986) and low error rates (AMRE = 1.27, MAE = 0.96). Likewise; a second linear model was developed to show the relationship between Class A evaporation pan evaporation, air temperature and wind speed. This model also exhibited a strong correlation (R = 0.956) with low error rates (AMRE = 0.89, MAE = 0.68). This study facilitates more effective irrigation management for farmers by providing a user-friendly smartphone application that calculates evapotranspiration, as many applications on smart devices.

**Keywords: I**rrigation dose, Evapotranspiration, Class A evaporation pan, Climate parameters, Modeling

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**WEEME'24-123-Ps**

**Contributing to the elimination of inorganic pollutants using waste from the palm trees of Ouargla (southern Algeria)**

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**Abstract:** The aim of this work is to evaluate the adsorption force of date palm waste (three types of date kernels) usedto remove lead ions from an aqueous solution. Activated carbon was chemically treated with phosphoric acid, while physical treatment was carried out at 800 °C in a tubular furnace under nitrogen flow. The surface morphology of the carbon was analyzed using a scanning electron microscope.

**Keywords**: Date palm, mineral pollutant, organic pollutant, adsorption, wastewater treatment.

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**WEEME'24-125-Ps**

**Treatment of injection water in Oil Field**

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**Abstract:** the exploitation of field naturally, leads to decrease the productivity of wells, to continue this exploitation with the best conditions, it is essential to pass to the stage of secondary recovery. The injection of water in reservoir is the most used method in the recovery of oil; unfortunately, there is an incompatibility between the injection water and the reservoir water, which poses a lot of problems such as training mineral deposits. The reservoir waters may contain alkaline ions and be brought into contact with the wash water which contains sulfate ions. The injected water eventually reaches the producing wells and in these wells the mixture is made and the precipitation of barium sulfate (BaSO4) takes place. The crystals then stick in the walls of the tubings, in a process that may be similar to that of sodium chloride, but this time the problem is more serious because it is a very compact deposit insoluble in the water also in acids. Deposits which formed during

production and shipping represent a real calamity against which oil producers have been fighting for several decades, deposits causing irreversible damage particularly dangerous for bottom production facilities such as surface and sometimes for the rock itself.

**Keywords:** water, reservoir, injection, barium sulphate, deposits, damage.

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**WEEME'24-126-Ps**

## Study of the adsorption mechanism of hexavalent chromium onto zeolitic imidazolate framework-11

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**Abstract:** This study investigates the use of synthesized Zeolitic Imidazolate Framework-11 (ZIF-11) for the removal of hexavalent chromium ($Cr(VI)$) from aqueous solutions via a stirring method. ZIF-11 membranes were synthesized, and their crystallographic structure was analyzed using a PANalytical X-Pert Pro, Empyrean Cu LFF HR DK417340 with Cu Kα radiation (λ = 1.54 Å), at a scan rate of 2°/min with a step size of 0.05° over a range of 4.99° to 90°. The accelerating voltage and applied current were 45 kV and 40 mA, respectively. The microstructure of ZIF-11 was examined using Scanning Electron Microscopy (SEM) with a QUANTA 650 instrument, operating in a vacuum environment at an accelerating voltage of 5 kV. Thermal stability was assessed under a nitrogen atmosphere with a NETZSCH STA 409PC/P instrument, at a scan rate of 10 K/min over the temperature range of 50 – 700 °C. Additionally, FTIR spectroscopy was employed to identify distinctive functional groups involved in the adsorption process, with spectra recorded using a Nicolet™ iS™ 10 spectrometer in the range of 400 - 4000 $cm^{-1}$. Characterization revealed ZIF-11's highly porous structure with irregular shapes and variable sizes. Optimal removal conditions were identified as pH 2.0, a stirring speed of 400 rpm, a contact time of 60 minutes, and a $Cr(VI)$ concentration of 10 mg/L. Thermodynamic and kinetic analyses supported the pseudo-second-order model and Langmuir/Temkin isotherms, indicating uniform $Cr(VI)$ distribution and spontaneous adsorption on ZIF-11 active sites. The maximum adsorption capacity was calculated to be 10.61 mg/g, demonstrating ZIF-11's effective adsorptive properties for $Cr(VI)$ and its potential as a promising adsorbent for $Cr(VI)$-contaminated solutions.

**Keywords:** ZIF-11, hexavalent chromium, $Cr(VI)$, adsorption, crystallographic characterization, Scanning Electron Microscopy.

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**WEEME'24-127-Ps**

## Enhancing Wastewater Microbiological Quality through Bio-Sand Filtration as a Point-of-Use Treatment Solution

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**Abstract:** This study investigates the physicochemical and morphological characteristics of three types of sand from the Ouargla region in southern Algeria: dune sand, medium sand, and coarse sand, collected from Sidi Khouiled, Hassi Sayeh, and Touggourt, respectively. The objective is to evaluate their potential use as Bio-Sand Filters (BSF) to improve the physicochemical and microbiological quality of treated wastewater at the Said Otba treatment plant in Ouargla, Algeria. Surface imaging conducted through Scanning Electron Microscopy (SEM) reveals distinct shapes and grain sizes across the three sand types, indicating differences in their textural properties. Furthermore, elemental and structural analyses using Energy Dispersive X-ray Spectroscopy (EDX) and X-ray Diffraction (XRD) confirm the presence of $SiO_2$ (α-quartz), $Al_2O_3$, and additional oxides such as iron, magnesium, and calcium oxides. These minerals are commonly associated with sand used in filtration processes, due to their stability and adsorption capacities. Although advanced analytical techniques incur high costs, the filtration results under optimized conditions were highly effective. The removal efficiencies for suspended solids (ESM), chemical oxygen demand (COD), and biochemical oxygen demand ($BOD_5$) were 92.54%, 83.72%, and 85.54%, respectively. Moreover, nitrogen compounds were significantly reduced, with removal rates of 97.67% for ammonia (N) and 92.06% for nitrate (N). Microbiological analysis showed substantial reductions in total germ count (GT), total coliforms (CT), fecal coliforms (CF), and fecal streptococci (SF), indicating a high level of pathogen removal. In summary, the study demonstrates the potential of Ouargla sands as effective BSF media, contributing to the enhancement of wastewater quality by reducing both contaminants and pathogens, thus supporting sustainable water management in arid regions.

**Keywords:** Wastewater, Microbiological quality, Sand, filter, Bacterial degradation, contaminants.

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**WEEME'24-128-Ps**

**Experimental study a brackish water desalination unit using a parabolic trough collector**

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**Abstract:** This study aims to evaluate the performance of a solar still device equipped with a heat exchanger (HE) using a parabolic trough collector (PTC). The parabolic trough collector has an area of 2 m² and is covered with a solar reflective chrome film. An aluminum tubular functions as the oil heater. The oil is positioned inside the tubular, serving to heat the water, which convert to steam. The results indicate a noticeable improvement in water output for the modified solar still when compared to the witness still. The modified solar still recorded a maximum hourly water yield of 0.53 l/m², whereas the witness still had a peak yield of 0.75 l/m².

**Keywords:** Solar energy, Water, Desalination, parabolic trough collector

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**WEEME'24-409-Ps**

**Numerical study of laminar flow by force convection of a hybrid nanofluid in a uniformly heated horizontal cylinder**

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**Abstract:** In this paper, fully developed laminar forced convection in a three-dimensional horizontal cylinder filled with binary hybrid nanofluid containing spherical shape of $Fe_3O_4$ and cylindrical shape of CNT suspended in water base fluid are numerically investigated. The cylinder is heated at the surface by a uniform heat flux. The dimensionless partial differential equations (PDEs) in cylindrical coordinates are discretized by finite volume method (FVM) with second-order precision. The Fortran code is used to solve the algebraic equations. The SIMPLER algorithm is used for the relationship between velocity and pressure. Thermal equilibrium and single-phase approach is adopted for $Fe_3O_4$, CNT nanoparticles and base fluid. Velocity and temperature distributions are illustrated by velocity contour and isothermal lines, respectively. The Nusselt number is analyzed to quantify heat transfer. This study will take into account the effect of Reynolds number $(500 \le \mathrm{Re} \le 2000)$ and volume fraction $(0 \le \varphi \le 4\%)$. The finding reveals that the Nusselt number is the increasing function of nanoparticle volume fraction and Reynolds number. In addition, the friction factor increases with volume fraction, while decreasing with Reynolds number.

**Keywords:** Forced convection; Cylinder; Hybrid nanofluid; Nusselt number; Friction factor.

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**WEEME'24-130-Ps**

**Treating winery wastewater using a new absorbent PLBC.**

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**Abstract:** Winery wastewater contains high levels of elements and chemicals that can be harmful to plants and animals if released without treatment. The increasing number of wineries and demand for wine contribute to the problem of winery wastewater. The use of winery wastewater can cause some elements to accumulate and leach into the soil and others. Biochar derived from plant sources has the potential to serve as a valuable tool for treatment purposes. Within the scope of this investigation, this project is pioneering, effective and environmentally friendly. The sustainable adsorbent, known as charcoal biochar (PLBC), is made from palm leaves native to the region of Biskra, Algeria. Adsorption experiments conducted on winery wastewater, with varying doses of the adsorbents, have shown remarkable effectiveness in removing several pollutants, especially turbidity. The conclusions drawn from this study clearly show that using the adsorbent, a cheap coal adsorbent can effectively treat winery wastewater.

**Keywords:** Water treatment, biochar, adsorption, effluents in wineries

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**WEEME'24-401-**

**Ps An attempt to unlock the potential of Algeria's rare earth bearing phosphorites through machine learning for industrial growth and green energy**

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**Abstract:** Algeria's mining potential holds strategic importance for boosting its national industry and supporting the global shift toward renewable energies, offering an alternative to the country's long-standing dependence on hydrocarbons. Among the critical resources that could drive this transition are rare earth elements (ΣREE), which are essential for modern technologies such as wind turbines, aerospace, transport, defence and various electronics. While ΣREE are crucial for the current and future global economy, their quantification in Algeria remains limited due to the high costs of analysis. preliminary geochemical investigations, particularly from the Tebessa region, have revealed a notable enrichment of ΣREE in phosphorite deposits, signaling a promising avenue for further exploration. This study marks the first systematic attempt to estimate ΣREE concentrations in 773 core samples from the Bled el Hadba (BHD) region in eastern Algeria, a location with significant phosphorite reserves. Leveraging machine learning techniques, we developed a predictive model based on major oxide data that includes measurements of $SiO_2$, MgO, CaO, and $P_2O_5$. The methodology for this study drew upon the use of geochemical data from the Gafsa-Metlaoui basin in Tunisia, to build the prediction model, which shares similar lithological and geochemical characteristics with the BHD basin, according to previous research. This cross-border geological continuity enabled the use of Tunisian data to enhance the reliability of ΣREE predictions in Algerian samples. Despite the limited scope of available oxides in the core samples, our machine learning model achieved a coefficient of determination ($R^2$) of 0.59, with RMSE =164.61. Predicted REE concentrations in the BHD phosphorites ranged from 163.72 to 341.11 ppm, with an average value of 238.10 ppm. These results, while promising, highlight the critical need for comprehensive geochemical analysis to improve estimation accuracy. Moving forward, this study will focus on estimating ΣREE tonnage for the first time in Algeria. The findings will provide crucial insights into the country's ΣREE resource potential, positioning Algeria as a key player in the global supply chain for critical minerals. To enhance the precision of future ΣREE estimates, we strongly recommend expanding the scope of oxide analysis in pre_existed core samples from all major phosphorite deposits across eastern Algeria.

**Keywords:** Mining potential, Algeria, Rare earth elements, Machine learning

**WEEME'24-402-Ps**

## Performance Analysis of Hybrid Heat Sinks with Various Configurations in a Forced Convection Environment

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**Abstract:** This paper presents a numerical simulation conducted using COMSOL Multiphysics 5.6 software to perform a transient 3D analysis of the thermal-hydraulic behavior of airflow within a horizontal channel. The system comprises three electronic components with variable power characteristics, cooled by hybrid heat sinks made of stacked rectangular and porous aluminum foam fins. The airflow is assumed to be laminar throughout the channel, and the primary objective is to assess the thermal-hydraulic performance of the system. The aluminum foam fins are modeled as porous media, employing the Darcy-Forchheimer-Brinkman model to describe their flow. The study

investigates the effects of air velocity ($u_o$ = 1.4 m/s), heat flux dissipated by the thermal sources ($q_s$ = 0.1×10⁴, 0.4×10⁴ W/m²), and variations in the configuration of the heat sinks (specifically, the orientation and height of the fins) on the temperature, velocity, and pressure distributions within the channel. The ultimate goal is to optimize cooling conditions for the electronic components.

**Keywords:** metal foam, simulation, heat sink, COMSOL Multiphysics, fin.

**WEEME'24-403-Ps**

### Investigation of the Thermodynamic Performance Parameters and Environmental Impact of (1,1,1,2-Tetrafluoroethane/Hydrocarbons (HCs)) Blends in Cooling Machinery

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**Abstract:** The present study emphasis on theoretical computation of the performance parameters of the standard thermodynamic cycle of vapor compression refrigeration unit using five sustainable working fluid mixtures ((R134a/R290), (R134a/R1270), (R134a/RC270), (R134a/R600a) and (R134a/R600)) as substitutes to the conventional working fluid R134a (1,1,1,2-Tetrafluoroethane) widely used in the refrigerating engineering, which has zero ozone depleting potential (ODP=0) and high global warming potential (GWP=1430). To reach this objective, a computer program was developed in MATLAB software to simulate the performance parameters of the selected working fluid mixtures like: specific cooling capacity, specific work input, pressure ratio, coefficient of performance and volumetric refrigeration capacity. The comparison was made at the constant condensation temperature (Tc) of 50 °C and the evaporating temperatures (Te) ranging from (-10 to 10 °C). In addition, the environmental properties (GWP and ODP) and the critical properties (Tc and Pc) of the studied working fluids are also investigated and compared with the pure R134a in this study. The results showed that the application of the binary blend (R134a/R1270) in the term of energetic performances, gives the highest values of the specific cooling capacity and the volumetric refrigeration capacity, the low values of the pressure ratio and the close values of the coefficient of performance to the single fluid R134a compared to the other working fluid mixtures under the same operating temperatures, while in the term of environmental impact, the (R134a/R1270) has the lower GWP value than the other studied refrigerants, which confirms that it could be a good suitable substitute for the traditional fluid R134a from the view point of performance parameters and environmental protection.

**Keywords:** (R134a/HCs) blends, Performance parameters, Environmental impact, Mechanical cooling machinery.

## Mechanics and Emerging Technologies & Materials Engineering

**WEEME'24-322-Ps**

### Study of the durability of Fiber-reinforced lime mortars

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**Abstract:** The Saharan regions of southern Algeria, such as the Laghouat region, are characterized by a hot and dry climate, with significant diurnal temperature fluctuations. As a result, the waterproofing of building terraces experiences concerning degradation due to the severe environmental conditions in these areas, which affect the durability of the materials used in these waterproofing systems. For this purpose, the use of lime mortars is beneficial in constructions located in the Saharan region, as these mortars provide better thermal insulation and low permeability to rainwater. During this study, we add steel fibers to lime mortar and examine the influence of the nature of alluvial-dune sand on the evolution of physical and mechanical properties, on one hand, and on the durability of the mortar (strength and impermeability) on the other hand. The goal is to achieve a lime mortar with good durability, allowing for its use in construction works, particularly in Saharan waterproofing applications.

**Keywords:** Lime mortar, sand, fibers, porosity, mechanical resistance, water absorption

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**WEEME'24-209-Ps**

### The numerical calculation of spatial derivatives distribution functions (MDFs) in one component plasma (OCP) through screened G. Kelbg potential

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**Abstract:** There are many reasons that lead to the broadening and the asymmetry of the spectral line shapes in plasma, where Stark effect plays a major role in this lines. The Stark effect is included in the final formulation of the spectral line formula by the electric microfield and its spatial derivatives distribution functions. In this work, Monte Carlo simulation was used to calculate the spatial derivatives distribution functions in hydrogen plasma, considering a corrected G. Kelbg potential. All interactions between plasma constituation shave been considered in the calculation. Some behaviors of spatial derivatives distribution functions have been deduced.

**Keywords:** plasma, G. Kelbg potential, Monte Carlo simulation, spatial derivatives distribution functions

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**WEEME'24-202-Ps**

### Numerical study of Ternary Hybrid Nanofluid Flow in Concentric Cylinders

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**Abstract:** The computational study of ternary Hybrid Nanofluid Flow between two concentric cylinders has been investigated. In addition, the combined effects of chemical reaction, thermal

radiation, shape facture of nanoparticle (i.e. spherical, cylinder and platelet) and ternary hybrid of nanoparticle (i.e., and ) in base fluid are taken into account. The modeling is based on nonlinear PDEs such as continuity, momentum and heat equations. These equations are transformed into a system of nonlinear ODEs using similarity transformations and then solved numerically and analytically. The analytical solution has been constructed using the Adomian decomposition technique (ADM). The present results in particular cases are compared to results obtained by the HAM- package for validation. The influence of active parameters the velocity, temperature and concentration, skin friction and Nusselt, Sherwood numbers and generated entropy are investigated.

**Keywords:** ADM method, Concentric cylinders, HAM-package, Shape factor, Ternary hybrid nanofluid.

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**WEEME'24-203-Ps**

## Nanoparticle aggregation effects on MHD nanofluid flow over a Permeable Stretching/Shrinking Sheet with velocity slip and thermal radiation

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**Abstract:** The aggregation of nanoparticles refers to the process by which individual nanoparticles come together to form larger clusters or aggregates. The aggregation of nanoparticles can be implied in drug delivery, imaging, sensors, oil and gas Industry, photothermal therapy, oil and gas industry, and energy storage. Thus, this research aimed to analyze the effects of both without aggregation and with aggregation of nanoparticles effects (i.e., titania-ethylene glycol) on the velocity and temperature profiles of over a permeable MHD Stretching/Shrinking Sheet with velocity slip and thermal radiation. The modified Krieger–Dougarty and Maxwell–Bruggeman models were utilized for nanoparticle aggregation. The basic partial differential equations resulting from mathematical modeling are turned into nonlinear ordinary differential equations using the similarity transformation. The calculated nonlinear equation was then numerically solved using the Runge-Kutta-Fehlberg 4th-5th order method with shooting technique and analytically via the ADM Approach. For validation, the results of this inquiry were compared to the results ofthe Mathematica software. In addition, the acquired analytical ADM data are compared to numerical RKF45 values and those given in the literature. It is found that when the sheet stretches or shrinks, the slip velocity is more extensive without aggregation effects, whereas an inverse relation is observed with aggregation effects. The temperature escalates with aggregation effects as compared to without aggregation effects. Finally, the aggregation effect reduces the surface drag force and heat transfer rate.

**Keywords:** Nanoparticles aggregation; Maxwell–Bruggeman models; Stretching/Shrinking Sheet; velocity slip; ADM Approach; Runge-Kutta-Fehlberg 4th–5th order; Shooting technique

**WEEME'24-301-Ps**

## Structural and Optical Properties of NiO Thin Films with Carbon Dots for Photocatalytic Application

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**Abstract: In this work, NiO** thin films were synthetized using a dip-coating technique at different **carbon dots nanostructures concentration**. The thin films were annealed at 450°C then characterized by X-ray diffraction (XRD), UV–visible spectrophotometer, wettability test and photocatalytic activity tester. X-ray diffraction analysis showed typical peaks of the NiO in face-centered cubic structure when the film is annealed at 450°C. UV-visible analysis exhibited transparency in the range of 70–80%. Increasing carbon dots structure, a slightly decrease of the transparency range of 60-70% was observed, as well as, no effect of the carbon quantities in the NiO film on the energy band gap calculated by the Tauc method which is around 3.92 eV. Contact angle measurements showed the super-hydrophilicity of NiO thin films. At constant UV irradiation time, the photo-degradation of methylene blue rate increased for NiO film with carbon dots at low concentration.

**Keywords: NiO thin films;** Carbon dots, Sol-gel processes, Photocatalysis

**WEEME'24-302-Ps**

## Weibull Statistic of the Mechanical Performances of Chamaerops humilis Palm Fibers for Eco-Friendly Green Composites

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**Abstract:** Natural fibers are prized mainly due to their lower density, economical, biodegradable, and little effect on the environment as replacement potential for glass or artificial fibers used in composite materials and sisal/flax yarns in ropes, Chamaerops humilis fiber (ChF) is gaining popularity. This study examined the quasi-static traction properties on 50 mm gauge length ChFs. seven groups (N = 30, 60, 90, 120, 150, 180, and 210) had 210 fibers analyzed. The dispersion was examined using variance analysis and Weibull distribution analysis because of the inherent heterogeneity in the mechanical properties of ChFs. The findings underscore the significance of comprehending the mechanical behavior of ChFs to optimize fiber-reinforced composite materials and offer insightful information about the possible uses of ChFs in the textile sector.

**Keywords:** Natural fibers, Chamaerops humilis, mechanical properties, Weibull, Kaplan-Meier's estimator, young's modulus

**WEEME'24-303-Ps**

## Biosynthesis, characterization of Copper nanoparticles and evaluation of their antimicrobial activity

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**Abstract:** The widespread emergence of antibiotic resistance, driven by the proliferation of microbial infections, has become a significant threat to public health, necessitating the development of new antimicrobial agents. The green synthesis of metallic nanoparticles has garnered considerable attention over the past decade due to its strong antimicrobial properties, ecological benefits, low environmental toxicity, and cost effectiveness. This study explores the biosynthesis of copper nanoparticles using a strain of actinomycete Gram-positive bacteria isolated from soil samples. According to molecular identification, the strain is closest to Streptomyces thinghirensis with 99.64%. The biosynthesis of copper Nanoparticles process employed the bacterial supernatant. Which confirmed by a visible color change from blue to green. The resulting copper nanoparticles demonstrated notable antimicrobial activity against several pathogenic bacteria, including Staphylococcus aureus, Pseudomonas aeruginosa, Klepsiela pneumonia and Escherichia coli. The physicochemical properties of the synthesized nanoparticles were characterized using energy dispersive X ray spectroscopy (EDX) and Scanning electron microscopy (SEM). EDX analysis revealed the elemental composition, confirming the presence of copper, oxygen and chlorine indicative of copper chloride hydroxide Cu2(OH)3Cl nanoparticles. The absence of hydrogen detection was attributed to the limitation of the EDX technique. Further characterization techniques including transmission electron Microscopy (TEM), X-Ray diffraction (XRD), and Fourier transform infrared spectroscopy (FTIR), are recommend providing a more comprehensive understanding of the nanoparticle synthesized.

**Keywords:** Copper nanoparticles, Streptomyces thinghirensis, green synthesis, Antibiotic resistance, pathogenic bacteria.

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**WEEME'24-304-Ps**

## Removal of some organic pollutants using photocatalytic degradation method

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**Abstract:** This work aims to attempt the removal of some pollutants, specifically dyes, represented by crystal violet (CV), from aqueous solutions using the photocatalytic decomposition technique and employing $TiO_2$ as a photocatalyst. The obtained results demonstrated a high efficiency of this technique in removing the pollutant, as complete removal of the pollutant CV was achieved after 60 minutes of irradiation in a basic medium with a pH of 9.

**Keywords:** photocatalysis, Crystal Violet (CV), organic pollutants, photocatalyst TiO2.

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**WEEME'24-305-Ps**

## First principles study of the Structural, Electronic and mechanical properties of intermetallic compounds

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**Abstract:** First-principles calculations of electronic parameters, mechanical and dynamical stabilities on superconducting properties of the body-centered tetragonal intermetallic lanthanum dicarbide LaC2 have been reported at zero and high pressures. The investigated properties have been established through both full-potential–linearized augmented plane wave (FP-LAPW) and plane-wave pseudopotential (PW-PP) approaches, in conjunction with the generalized gradient approximation (GGA). Our investigations validate that the LaC2 crystal has a mechanical and dynamical stability under normal conditions. The generalized mechanical stability criteria applied to compressed LaC2, suggest that the compound remains stable for pressures below 18.30 GPa. The evaluated superconducting critical temperature Tc and the electron-phonon coupling parameter λ at zero pressure are found to be in excellent concordance with the experimental data. Furthermore, at elevated pressures, Tc and λ are predicted to decrease and the normalized specific heat jump remains unchanged.

**Keywords**: LaC2; Electronic structure; Elastic properties; Pressure; Phonons; Superconductivity.

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**WEEME'24-307-Ps**

## Thermal properties of plaster filled with date palm rachis

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**Abstract:** Climate data show that the elements of climatic comfort in desert buildings are not available most of the year, as desert areas are characterized by hot and long summers and cold winters, so it is necessary to use techniques and methods that reduce temperatures inside buildings. To achieve this, and in order to contribute to the valorization of local resources, we studied the effect of adding date palm rachis on the thermal properties of plaster. Where we added date palm rachis in the form of gravel and in the form of layers for plaster by 1% to 5%. The results of the experiments showed a noticeable improvement in the thermal conductivity and specific heat of the samples. As the thermal conductivity of plaster samples reinforced with date palm rachis in the form of layers decreased by 34% and by 20% when adding granulated date palm rachis, and the specific heat decreased by 27% for multilayered date palm rachis reinforced plaster samples and 20 % for granulated date palm rachis reinforced plaster samples.

**Keywords:** plaster, date palm rachis, thermal conductivity, specific heat.

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**WEEME'24-308-Ps**

## Effect of Adding Alfa Plant Powder on Thermal and Mechanical Properties of Fired Earth Bricks

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**Abstract:** Fired earth bricks have been used for thousands of years in construction due to their environmental properties and sustainability. Despite advancements in construction materials, these bricks struggle with poor thermal performance. Researchers are exploring ways to improve this by adding natural materials to the brick composition to enhance porosity or incorporating chemical materials whose interactions within the brick structure increase the amount of trapped air for the same purpose. This article presents an experimental study on adding Alfa plant powder to fired bricks to improve their thermal while maintaining its mechanical properties within the field of recommendations. The Alfa plant powder was added in proportions of 0%, 10% and 15% by weight of the soil matrix, which is primarily composed of clay and dune sand. The samples underwent tests for thermal conductivity, thermal diffusivity, compressive strength, and flexural strength. The results showed that the addition of Alfa plant powder improved the thermal performance of fired earth brick but negatively affected the mechanical performance of the brick samples. If this powder is added in a reasonable proportion, it can meet certain international standards.

**Keywords:** Fired Earth Brick, Clay, Dune Sand, Alfa Plant Powder, Thermal Proprieties, Mechanical Proprieties

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**WEEME'24-312-Ps**

## Comparison of Si/Al2O3 and TiO2/Al2O3 One-Dimensional Photonic Crystals as Omnidirectional Bragg Reflectors in the Visible and Infrared Spectrum

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**Abstract:** One-dimensional photonic crystals, commonly referred to as Bragg reflectors, are suitable as omnidirectional reflectors due to their relatively low thickness compared to conventional omnidirectional reflectors for photovoltaic and thermophotovoltaic applications. This study explores the use of one-dimensional photonic crystals as omnidirectional reflectors by comparing the structural and optical performance of Si/Al2O3 and TiO2/Al2O3 configurations. The reflectance spectra were measured using the transfer matrix method across different incidence angles and layer periods (N = 6, 8, 10) in the visible and infrared ranges. The bandgap properties of both structures were analyzed. The results indicate that the Si/Al2O3 structure exhibits a wider bandgap compared to the TiO2/Al2O3 structure, suggesting its potential for improved performance in specific optical applications. This finding could have implications for the design and optimization of photonic devices in both the visible and infrared spectrum.

**Keywords:** 1D Photonic Crystals, Reflectance Spectrum, Bragg Reflectors, TiO2/Al2O3, Si/Al2O3.

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**WEEME'24-311-Ps**

## Influence of annealing temperature on indium oxide thin films properties

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**Abstract:** High transparent $In_2O_3$ nanocrystalline thin films were prepared using a simple sol–gel method followed by a spin coating technique on glass substrates. In order to study the influence of the annealing temperature on the structural, optical and electrical properties of the produced films, we changed the annealing temperature from 250 °C to 550 °C with steps of 100 °C, We have three characterization techniques which are X-ray diffraction to determine the films structure, UV–vis spectroscopy for determination the optical proprieties of thin films and two-point probe method to establish the electrical conductivity. The thickness of the films is reduced from 232 nm at 250 °C to 155 nm at 550 °C. The XRD analysis shows that the films have cubic structure with a preferred growth orientation along the (222) plane, the average size of crystallites varies from 12 to 23 nm, the transmittance of the films is between 80% and 83% in visible rang and the band gap exhibited a decrease from 3.98 to 3.47 eV. Moreover, the electrical resistivity decreases with increase in annealing temperature and a minimum electrical resistivity of 14.05 Ω.cm was obtained for the film coated at 550 °C.

**Keywords:** Thin films, Indium oxide, Spin coating, Annealing temperature, Structural properties, Optical properties, Electrical properties.

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**WEEME'24-310-Ps**

## Characterization of Antioxidant Activity and Release Kinetics of Essential Oil Encapsulated in Sodium Alginate and Gelatin

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**Abstract:** Essential oils (EOs) are natural compounds present in aromatic and medicinal plants known for their antimicrobial and pesticidal activities and have been the subject of many studies. In this study, microcapsules of essential oil were prepared through the complex encapsulation of the essential oil using sodium alginate and gelatin. Significant differences in the EO microcapsules were observed, attributed to variations in the essential oil-to-polymer ratio, which influenced oil retention and encapsulation efficiency. The resulting EO microcapsules demonstrated excellent thermal stability, crystallinity, and antioxidant activity. An in vitro digestion study revealed that the encapsulated EO exhibited a sustained release profile within both gastric and small intestinal conditions. The release profiles were analyzed using various mathematical models to simulate the release kinetics. This study highlights the potential of Juniper berry essential oil microcapsules as multifunctional ingredients, serving as antioxidants and antimicrobial agents.

**Keywords:** Sodium Alginate; Microencapsulation, Antioxidant, essential oil

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**WEEME'24-313-Ps**

## Fractional Modeling of Dopant Diffusion in Silicon for the Formation of p-n Junctions in Photovoltaic Cell by using Caputo-Fabrizio Derivative

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**Abstract:** In recent years, fractional calculus methods have seen wide applications in modelling various physical phenomena and chemical processes, including the study of dopant diffusion in materials such as silicon. In this context, the fractional derivative introduced by Caputo and Fabrizio has been utilized to investigate the effect of this derivative on dopant diffusion within silicon for the formation of p-n junctions in photovoltaic cells. A mathematical model was developed based on a fractional order time and spatial derivative, where the results showed that the order of the fractional derivative plays a crucial role in the diffusion behaviour and the depth of the formed p-n junction. These findings highlight the promising potential of using fractional calculus in optimizing the design of p-n junctions in solar cells.

**Keywords:** silicon, Caputo-Fabrizio, Fractional calculation, diffusion, doping, p-n junction, Photovoltaic Cells.

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**WEEME'24-314-Ps**

## Contribution To The Modeling Of The Short-Term Behavior Of Cured Concrete In Hot Weather

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**Abstract:** Several problems result from concreting in hot weather, where most of them appear in the short term, especially the excessive water evaporation rate from the concrete surface, which induces plastic shrinkage, then results in cracks; if specials procedures not done correctly, also the mechanical characteristics of concrete will reduce. Therefore, simulating the behavior of concrete in the short term in hot weather will allow us to predict these problems and provide the appropriate procedures to remedy these problems in time, specially plastic shrinkage. This study aims to determine concrete behavior at an early age, precisely in the first 24 hours of hydration under a hot curing temperature, through two parts: The first step is a practical part, based on a concrete mixture for studying the problems related to concrete cured in hot curing weather, plastic shrinkage cracks and the evaporation rate measured on a mini-slab, and for the simulation, we use a climatic chamber. The second part is a numeric simulation, which consists of the simulation of the practical part using COMSOL software. The results showed during the first hours of the test; that the temperature and humidity distribution are different along the mini-slab; also, the numerical simulation of concrete at curing temperature converges to the experimental case, and the front part of the mini-slab (facing the heat flow) hardens faster than the second part. The numerical simulation allowed us to Know the exact time the beginning of cracking.

**Keywords:** Concrete, Curing Temperature, Hot Weather, Modeling, Evaporation rate, Plastic Shrinkage

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**WEEME'24-315-Ps**

## Assessment of the Impact of Pressure on Stresses in A Damaged Pipeline Conducted Analytically and Using FEM

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**Abstract:** Pipelines are not only essential for the transportation of vital resources, but they also have a significant economic impact. They contribute to the growth of industries and reduce transportation costs. It is important to understand that the integrity of the pipeline can be compromised by the presence of defects. These defects may threaten the integrity and durability of the pipeline under internal pressure. Evaluating the stresses such as the hoop stress and the longitudinal stress is crucial in the analysis and design of pipelines, it is also essential to estimate potential risks and take appropriate corrective measures. In this study, we considered a pipeline with an external rectangular defect. For greater accuracy, we compared the results of stresses obtained from the theoretical equations with those from the finite element method (FEM). The numerical simulation of the mechanical behavior of the damaged pipeline was studied using ANSYS software. To expand our study, we varied the internal pressure to analyze the stresses in the damaged zone after the determination of the boundary conditions. We noticed that, for the hoop stress, the values from the finite element method are higher than those from the theoretical equations, and the error is moderate to high. For the longitudinal stress, the values from the theoretical equations are slightly higher than those obtained from the finite element method with a low error. In conclusion, the stresses have a proportional relationship with the variation in internal pressure in the pipeline, and the material remains in the elastic zone during all the considered pressure values, as the hoop and longitudinal stresses are below the material's elastic limit.

**Keywords:** Pipeline, Defect, FEM, Stress.

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**WEEME'24-317-Ps**

**Photocatalytic Degradation Of Methylene Blue Dye From Aqueous Solution**

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**Abstract:** In this work, we use the advanced oxidation process (AOPs) to remove an organic pollutant (Methylene Blue) from an aqueous solution. From there, we select the photocatalytic degradation method, which includes titanium dioxide ($TiO_2$). $TiO_2$ has attracted more attention and interest from many researchers due to its exceptional properties, such as good photocatalytic activity, chemical stability, and long-term corrosion resistance. We investigate in this study the impact of various factors on the degradation rate as pH.

**Keywords:** Advanced Oxidation Process, Organic Pollutant, Methylene Blue, Photocatalytic Degradation.

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**WEEME'24-319-Ps**

**La1-xSrxFe0.7Ni0.3O3, new material for energy applications**

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**Abstract:** Perovskite-type oxides with $ABO_3$ structure have been known in recent years for their applications in areas such as solid oxide fuel cells (SOFC), catalyst for various reactions such as fuel reforming and hydrogen production. It is known that the purity of the perovskite phase of the material, as well as the fine particle size and sufficiently large specific surface area, significantly influence the performance and value of these oxides. Perovskite powders $La_{0.7}Sr_{0.3}Fe_{0.7}Ni_{0.3}O_3$ were prepared by the sol-gel method and calcined at different temperatures for 5 hours. These powders were characterized by X-ray diffraction (XRD) and infrared spectroscopy to study the evolution of the structure up to the attainment of the pure phase, as well as the crystallite size as a function of composition and calcination temperature for the compound x=0.3 using the Scherrer relation. Transmission electron microscopy (TEM) was performed to confirm the crystallite sizes of the different compounds. The results show smaller sizes depending on the composition up to x=0.2, the substitution limit; as for temperature, there is a decrease in size with an increase in temperature. These smaller crystallite sizes suggest a relatively large specific surface area, indicating significant catalytic activity for reactions at the cathode or anode in fuel cells.

**Keywords:** Perovskite, XRD, FT-IR, specific surface area, TEM, SOFC.

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**WEEME'24-321-Ps**

**Factors Influencing the Fracture Toughness of Bioplastic Starch Reinforcements in Date Palm Fiber**

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**Abstract:** In this study, date palm fibers of varying lengths and weights were employed as reinforcement materials for starch-based bioplastics, and the Toughness modulus of the resulting samples was subsequently measured. The findings revealed that composites reinforced with date palm fibers exhibited greater continuity in Toughness modulus and resistance. This difference became more pronounced when compared to the starch matrix, with the Toughness modulus of the date palm fiber-reinforced composites improving by 1.64 times compared to the starch matrix (Biop).

**Keywords:** Bioplastic, Fracture Toughness, Palm fiber, Reinforcements, Starch.

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**WEEME'24-325-Ps**

**Preparation and characterization of NiO nanoparticles**

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**Abstract:** Thin films of p-type semiconductors, such as nickel oxide (NiO), are in demand for multiple applications in optoelectronic devices. NiO has gained attention due to its chemical stability and advantageous optical, magnetic and electrical properties. The study carefully considered the structural and optical attributes of thin films comprising undoped nickel oxide (NiO) and nickel oxide doped with lithium (Li), with volumetric contents of 1% and 3%. These films were prepared using the spray pyrolysis technique (SPT). According to X ray diffraction patterns, deposited films are cubic polycrystalline, with the prominent peak located at the (200) plane. The investigation provides assurance that Li doping had no impact on the main peak's structure. The range of 70.061–74.309 nm was chosen as the average crystallite size. All films were observed to have transmittance values exceeding 80%. The optical energy gap values of the investigated films were found to range between 3.45 and 3.59 eV.

**Keywords:** NiO, optoelectronic, X ray diffraction, energy gap.

# 2nd Session

## Water Management & Energy Systems

**WEEME'24-404-Ps**

### Design and sizing of a solar pumping system for an agricultural field

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**Abstract:** Solar photovoltaic energy is currently experiencing significant growth and represents an ideal solution for water supply, particularly in rural and isolated areas. This work focuses on the design and sizing of a solar pumping system for irrigating an agricultural field, aiming to replace grid electricity or generator power with the existing solar radiation in our agricultural field located in Biskra. Finally, we have conducted a preliminary study on the estimated cost of our investment and considered the system's impact on the environment.

**Keywords:** Solar energy, solar pumping, investment, agricultural field.

**WEEME'24-406-Ps**

### An Experimental Study of Hydrogen Production Through a Photovoltaic System in The Ouargla Region, Algeria.

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**Abstract:** An experimental study on small-scale for solar hydrogen production system via a Proton Exchange Membrane electrolysis under a desert climatic condition in Ouargla region (South- East of Algeria). The system uses two NM 54 polycrystalline photovoltaic panels; the power ofeach one is 250 W, a power control unit contains converters combined with a proton exchangemembrane (PEM) electrolyser. Has been carried out, the target of this study has been to evaluatehydrogen production by water analysis and to store the solar energy which has had the form ofa hydride-

metal hydrogen. At the end of the five-hour experiment, the actual amount of hydrogen blown was about 150 litres.

**Keywords:** Experimental study; Hydrogen. Photovoltaic panels; Ouargla region; electrolyser.

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**WEEME'24-407-Ps**

**Speed Control of a Permanent Magnet Synchronous Wind Turbine**

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**Abstract:** The objective of this work is to study by simulation of speed control of a permanent magnet synchronous machine (PMSM). After simulation of the wind turbines, a supply consisting of two converters three-phase PWM vector. Modeling in the Park of this generator has been presented, and its vector control. Then, in order to ensure real-time tracking of the optimum operating point and having a maximum production of electrical power for different wind speeds, at first we used a conventional PI speed controller, in order to increase the degree of efficiency and improve the performance of our system.

**Keywords:** PMSM; Wind turbines; speed Control, MPPT, PWM vector

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**WEEME'24-408-Ps**

**An Artificial Neural Network-Based Predictive Control Model for Grid-Connected Inverter**

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**Abstract:** Integrating artificial neural networks (ANN) to enhance photovoltaic systems is crucial for two primary reasons. First, artificial intelligence (AI) technologies are advancing rapidly and are being widely adopted across various fields, such as medicine and agriculture. Second, there is an increasing global demand for energy, coupled with the necessity to reduce reliance on conventional energy sources that contribute to carbon emissions and climate change, highlighting the importance of transitioning to sustainable solutions. Photovoltaic systems have emerged as a leading renewable energy source, making it imperative to improve their efficiency and reliability. However, integrating these systems with existing power grids presents significant challenges, including maintaining consistent performance and managing fluctuations in energy production. This paper presents a novel approach for grid-connected inverter control by integrating ANN with Model Predictive Control (MPC) to enhance the efficiency of grid-connected photovoltaic (PV) systems. After training the ANN model on large-scale datasets, with a particular focus on variations in inductance values, the ANN-MPC approach acquires the ability to adaptively correct the inductance, resulting in a relatively model-free control technique. Simulations of the proposed approach confirm its effectiveness and flexibility, demonstrating its capability to improve the performance of grid-connected PV systems.

**Keywords:** Artificial Intelligence (AI), Photovoltaic Systems, Artificial Neural Networks (ANN), Model Predictive Control (MPC), Two Level Voltage Source Inverters (2L-VSIs), Grid Connected.

**WEEME'24-129-Ps**

### Wastewater Treatment and Sustainable Use of Water Resources in Arid Areas

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**Abstract:** Industrial wastewater is not only one of the main causes of irreparable damage to environmental balances but also contributes to the depletion of freshwater reserves, posing threats to future generations. Water treatment in the oil industry is one of the primary challenges in this sector. This wastewater has highly variable compositions depending on the nature of the process. It usually contains large amounts of: dissolved organic substances (benzene, toluene, ethylbenzene, xylene, phenols, and organic acids), suspended organic matter (hydrocarbons, oils, and greases), dissolved inorganic substances (heavy metals, sulfates, nitrites, and nitrates), biodegradable materials, and dissolved salts (chlorides and bromides). These liquid wastes constitute a class of hazardous organic chemicals, some of which have toxic effects and are known to be highly carcinogenic. They pose a significant threat to public health. This pollution can have a direct or indirect impact on humans, animals, and the balance of ecosystems. This study describes the electrocoagulation and sand filtration processes for the treatment of industrial wastewater. The preliminary results obtained show that this method is promising, and further investigations and analyses are necessary to optimize various parameters.

**Keywords**: Wastewater Treatment; Industrial Pollution; Electrocoagulation; Sand Filtration; Sustainable Water Use.

**WEEME'24-410-Ps**

### Stopping power calculation of 12C, 16O ions in Mylar and Polycarbonate targets for the energy range from 1,1 to 7,1 MeV/n

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**Abstract**: The measure of stopping power for swift ions is important for studies in several fields of fundamental and applied sciences such as radiation dosimetry, medical physics, ionic implantation and many others. In particular, compilations of stopping power for light ions (alpha particles) are essential because it can contribute to find the 12C, 16O ions stopping power, which is the aim of this work. The modified Bethe-Bloch stopping power's expression depends on several correction terms, the most important of these is undoubtedly the shell correction its contribution can exceed 13% of the stopping power especially for energies of a few MeV/n in heavy targets. In the present work a new expression of stopping power has been deduced from modified Bethe-Bloch formula without the need to determine the shell correction, and target excitation potential. This expression is based on the using of experimental data for alpha particles given with good precision compiled by the nuclear data section of International Atomic Energy Agency (IAEA), and has been applied to determine the stopping power of heavy ions 12C, 16O traversing composite targets (polymers) Polycarbonate and Mylar for energies ranging from 1,1 to 7,1 MeV/n by using Bragg-Kleeman

expression for composite targets and the appropriate expression of the effective charge. A good agreement has been found between our calculated results, and those obtained by SRIM-2013, MSTAR calculations codes and the experimental data of stopping power generated by the (IAEA).

**Keywords:** Bethe-Bloch formula, shell correction, excitation potential, SRIM-2013

**WEEME'24-411-Ps**

## Stopping power calculation of $^{1}H$, $^{7}Li$, $^{12}C$, $^{16}O$ ions in Polycarbonate, and Mylar targets for the energy range from 1.1 to 7.1 MeV/n

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**Abstract**: The modified Bethe-Bloch stopping power's expression depends on several correction terms, the most important of these is undoubtedly the shell correction its contribution can exceed 13% of the stopping power especially for energies of a few MeV/n in heavy targets. In the present work an expression of stopping power has been deduced from modified Bethe-Bloch formula without the need to determine the shell correction, and target excitation potential. This expression is based on the using of experimental data for alpha particles given with good precision compiled by the nuclear data section of International Atomic Energy Agency (IAEA), and has been applied to determine the stopping power of $^{1}H$, $^{7}Li$, $^{12}C$, $^{16}O$ ions in Polycarbonate (Makrofol) and Mylar targets for energies ranging from 1.1 to 7.1 MeV/n. A good agreement has been found between our calculated results, and those obtained by SRIM-2013, PSTAR, MSTAR calculations codes and the experimental data of stopping power generated by the (IAEA).

**Keywords:** Stopping power, $^{1}H$, $^{7}Li$, $^{12}C$, $^{16}O$, Makrofol, Mylar, Modified Bethe-Bloch formula,

**WEEME'24-412-Ps**

## Feasibility Study of Solar Drying of Clay Bricks

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**Abstract:** This study examines the possibility of using solar energy to dry clay bricks. To this end, a new solar dryer has been designed in order to dry the clay bricks. The solar dryer consists of an absorber plate, a plastic cover, a chimney and insulation. The clay bricks used in this experiment are brought from industrial unit (brickworks). During this study, several experiments were carried out, the thermal efficiency of the solar dryer was tested and the drying parameters were analyzed. The quality of bricks dried under the solar dryer was compared with that of bricks dried under the industrial method. The obtained results show that drying air temperature reached 72°C during the experiment, which is acceptable to perform the drying process of clay bricks. The drying time for a clay bricks at a temperature between 40°C and 72°C is five (05) hours. The results confirm the possibility of using solar energy to dry the clay bricks.

**Keywords:** Solar drying, Clay bricks, Solar energy, Solar dryer

**WEEME'24-416-Ps**

## Comparative study of EAHE system in different regions of Algeria

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**Abstract:** The thermal inertia of the soil allows for maintaining a stable temperature at certain depths, regardless of the variations in air temperature at the surface. This property inspires the idea of harnessing this stability by using an air-to-soil heat exchanger buried at appropriate depths. Air circulates through this exchanger to be later used for cooling buildings in the summer, this work aims to study the parameters influencing the thermal behavior of this heat exchanger for different regions of Algeria, such as Algiers, Biskra, Béni Abbès, and Aïn Salah. This study has enabled the calculation of soil temperature at any depth and for any day of the year and for different tube length.

**Keywords:** EAHE, heat exchanger, cooling system, heat transfer

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**WEEME'24-417-Ps**

**Neutronic simulation of the small modular reactor CAREM-25 using OpenMC code**

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**Abstract:** The idea of an integrated Small Modular Reactor (SMR) is not new, but it seems that is time to put it back into the circuit within today's energy context. SMRs are defined as reactors producing an electric output power ranging between 10 MWe and 300 MWe. IAEA (the International Atomic Energy Agency) publications state that the use of these kinds of reactors has attracted the attention of many industrial countries. According to the actual situation, SMRs are at different stages of design, licensing, and construction. Many technologies are proposed, including inherent concept of the widely used pressurized water reactors. The aim of this study, is to use OpenMC code for the modeling and simulating of an PWR-like SMR model. The Argentinian CAREM-25 reactor is studied within the framework of a neutronic analysis of a configuration with standard fuel made from metallic UO2. Neutron flux, reaction rates and neutron spectrum of the reactor are obtained through OpenMC simulations.

**Keywords:** SMR, OpenMC, CAREM-25, Neutronic, simulation.

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**WEEME'24-420-Ps**

**Electrochemical Behaviour of Modified Electrode: GCE/Poly [4 -(Pyrrol-1-Yl Methyl) Benzoic Acid]-Nickel**

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**Abstract:** The poly[4-(pyrrol-1-yl methyl) benzoic acid]-Ni (PPyBA-Ni) film electrodeposited on a glassy carbon electrode (GCE) has been characterized by cyclic voltammetry and impedance

spectroscopy. The electrodeposition of polymer film is carried out by electrochemical oxidation of the monomer in $CH_3CN$/TBAP ($10^{-1}$ M) solution. The incorporation of metal particles is obtained by soaking the PPyBA/GCE modified electrode in aqueous solution containing $NiSO_4$ for complexing the metal cation by the polymer film through the carboxylic acid group. This is followed by an electroreduction of the complex formed to precipitate the metal particles in the polymer film. Analysis of the modified electrode to which we made several successive operations: soaking, reduction and oxidation shows that its physicochemical properties remain unchanged even after several operations. This suggests that the obtained composite material has a good electrochemical stability, which makes possible its use as electrode material in various applications like electroanalysis, electrocatalysis and as electrode materials in electrochemical generators and for recuperation of transition metals from rejected wastewater.

**Keywords:** PPyBA-Ni, Modified electrode, Incorporation, Nickel, Cyclic voltammetry, Electrochemical Impedance Spectroscopy.

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**WEEME'24-421-Ps**

## Optimal Integration of PV/DSTATCOM Systems in Reconfigured Distribution Networks

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**Abstract:** This paper presents an approach for optimal reconfiguration of a distribution network in the presence of both solar photovoltaic (PV) units and distribution static synchronous compensator (DSTATCOM) devices. The main objective is to determine the best allocation and size for two PV/DSTATCOM systems, as well as the optimal network topology, in order to reduce the power losses, improve the voltage profile, and enhance network stability. To solve this multi-objective optimization problem, we used Artificial Rabbit Optimization (ARO) algorithm. The study was carried out on a standard IEEE 33-bus distribution network to demonstrate the effectiveness of our approach. The results obtained show that ARO optimization algorithm is particularly effective in planning the integration of distributed PV power production and DSTATCOM devices, while also considering network reconfiguration. Specifically, total active power losses decreased by 92.01%, from 210.9876kW to 16.8626kW. The total voltage deviation decreased by 96.73%, from 1.8047p.u. to 0.059p.u., and the voltage stability index increased by 25.02%, from 25.5395p.u. to 31.9302p.u.

**Keywords:** Active power losses, Artificial Rabbits Optimization, distribution networks, multi-objective function, PV/DSTATCOM systems.

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**WEEME'24-422-Ps**

## Techno-Economic Optimization of Integrating Renewable Distributed Generation into Distribution Networks Considering Hourly Variations in Load, Climatic Conditions, and Energy Prices

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**Abstract:** This paper investigates the techno-economic impacts of integrating renewable distributed

generations (DG), such as solar photovoltaic DG (PVDG) and wind turbine DG (WTDG), into the distribution network. The study employs the Walrus Optimization Algorithm (WaOA) to determine the optimal location and size of renewable DG units, with the objective of minimizing active power losses, improving voltage profile, and reducing overall installation costs. The optimization problem considers load variations, climatic conditions (ambient temperature, solar irradiation, and wind speed), and energy price fluctuations. To evaluate the proposed method, the standard IEEE 69-bus distribution network is employed. The results show that the integration of two PVDG units at nodes 12 and 64, with nominal active powers of 751.23 kW and 300.9 kW respectively, along with two WTDG units at nodes 18 and 61, with nominal powers of 500 kW and 2250 kW respectively, reduces active energy losses by 84.11%, from 4073.054 kWh to 647.115 kWh. Additionally, the total voltage deviation decreases by 72.15%, from 38.0386 p.u. to 10.595 p.u. The total cost also drops by 48.48%, from $7.69\times10^6$\$ to $3.9622\times10^6$\$.

**Keywords:** Walrus Optimization Algorithm, distribution network, distributed generation, techno-economic optimization, solar photovoltaic, wind turbine.

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**WEEME'24-423-Ps**

### Numerical Investigation of Eccentricity effects on Laminar Free Convection in a Gap between Two Cylinders.

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**Abstract:** This work aims to study the steady state two-dimensional laminar natural convection of Newtonian fluid between an inner cylinder which was put eccentrically into an outer one numerically. The cylinders have constant temperatures where the inner one $T_h$ is higher than the outer one $T_c$ ($T_h>T_c$). The simulations covered ranges of $10^3\leq Ra\leq10^5$, $0\leq\varepsilon\leq0.9$ and an inclination angle $\varphi$ from 0° up to 90°. The maps of isotherms and streamlines are taken for the previous parameters, the average Nusselt number is obtained and discussed as well. The results revealed that the average Nusselt number has the highest values [1] when $Ra=10^5$ at $\varphi=0$ which is a signal for the large transfer herein and has the lowest values for $Ra=10^3$ at $\varphi=90°$ which is a signal that the transfer is by conduction more than convection. Furthermore, the increasing of eccentricity causes an increase in the Nusselt number for all the cases. Finally, the case where we can get the best heat transfer is at $\varphi=0$, $\varepsilon=0.9$ among them all. The results have compared with some previous works and showed good agreement.

**Keywords:** Natural convection, Eccentric enclosure, Nusselt number, Heat transfer, Laminar model.

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**WEEME'24-424-Ps**

### Optimization of energy storage in a solar water heater

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**Abstract:** This work aims to numerically study the importance of phase change materials (PCMs), by analyzing their potential for storing solar energy by latent heat of a phase change material in a domestic hot water system. The study consists of comparing the thermal behavior of two solar

water heaters: a conventional solar water heater and a PCM solar water heater.

This work presents an analysis of the experiment aimed at studying the effect of paraffin on water heating. Different amounts of paraffin were used under controlled conditions to determine their impact on water temperature. The results show that paraffin acts as an efficient heat storage agent. The greater the amount of paraffin, the more the water temperature increases proportionally. This suggests that increased amounts of paraffin allow better use in large-capacity water tanks, thus offering interesting perspectives for applications requiring efficient thermal storage.

**Keywords:** PCM, solar energy, water heating

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**WEEME'24-428-Ps**

**Effect of fins number on the thermal performance of a parabolic trough collector**

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**Abstract:** Effect of fins number on thermal performance of a parabolic trough collector is studied numerically in the current work. Fins number used are 1, 3,5and 7. The study is solar collector using three-dimensional Computational Fluid Dynamics (CFD) simulation with Fluent software. The parabolic collector has a longer of L=1m, inner diameter Di=0.066m and outer diameter Do=0.070m. Results are validated with comparing model results (Nusselt number and friction factor) with suitable correlations, and experimental results. The study is found for different values of Reynolds number varied from 4000 to 20000. Appropriate boundary conditions were used and a suitable mesh was chosen. The use of fins cause an increasing in the working fluid movements and turbulent intensity and generating vortex Results shows that the augmentation of fins number cause increasing in the Nusselt number and friction factor gradually, so increasing in the thermal performance of the parabolic trough collector by 20 %.

**Keywords**: fins number; parabolic collector; thermal performance; heat transfer.

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**WEEME'24-430-Ps**

**Optimal working pairs for adsorption cooling applications**

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**Abstract:** This study suggests a detailed comparison of 4 working pairs intended for use in adsorption cooling systems. The performance analysis was based on two indicators: adsorption capacity and coefficient of performance. Based on a reformed form of the DubinineAstakhov equation. It was found that maximal $COP_{th}$ is obtained by CarboTech C40/1/methanol followed by by AC-35, G32-H and NORIT RX3-Extra. At a condenser temperature of 30 °C, with an adsorbent mass of 21 kg.

**Keywords:** Solar energy, Cooling, Adsorption, Optimal coefficient of performance.

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**WEEME'24-432-Ps**

**Green hydrogen production potential for M'sila province in Algeria with solar energy**

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**Abstract:** This paper studies the potential of green hydrogen production from solar energy in M'sila, Algeria. The hydrogen production potential from solar photovoltaic energy is forecasted for the study period of one year. Polycrystalline photovoltaic (PV) panel with 175 Wp rated power and proton exchange membrane (PEM) electrolyzer are employed. The required economic study is conducted to calculate the levelized cost of electricity (LCOE) and hydrogen (LCOH2). The results showed that hydrogen production potential ranges from 11.96 to 35.8 Kg/m2/ month. Furthermore, cost of hydrogen production from solar resources in M'sila is competitive, where the price of 1 Kg of hydrogen is 2.13 $/Kg. This study concludes that hydrogen production from photovoltaic installation is an opportunity to lead the country towards sustainable energy solution.

**Keywords:** Hydrogen production, Hydrogen potential, Solar energy, PEM elctrolyse, Economic analysis.

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**WEEME'24-433-Ps**

**Design and Cost Evaluation of Photovoltaic Systems Based on Real-World Results in Algeria**

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**Abstract:** Solar energy stands out as an infinite, sustainable, yet unpredictable energy source compared to other available alternatives. This paper explores the feasibility of installing an off-grid photovoltaic (PV) system with battery storage in a typical residential area in Messila, Algeria. The study focuses on evaluating solar radiation and assessing the system's technical and economic viability for meeting household electricity demands. The simulation was conducted using the PVsyst 6.6.8 software. The findings indicate that the system's energy output varies throughout the year, with peak production occurring during the summer months (June to August) and the lowest output in February. These insights are crucial for optimizing future energy utilization.

**Keywords:** PVsyst 6.6.8, solar energy, battery storage

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**WEEME'24-434-Ps**

**Optimal Renewable Distributed Generators Allocation in Distribution Network with Various Load Models**

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**Abstract:** Insertion of renewable energies in distribution networks has grown over the years. Distribution networks planning are facing several problems, including asset congestion, voltage fluctuations, and system instability. This article present the optimal allocation of renewable

distributed generators in distribution networks with technical objective like minimization of total active power losses using the Dragonfly Algorithm (DA) in different load models scenarios are to be investigated. Practical voltage-dependent load models, that is, residential, industrial and commercial have been adopted for investigations. The effectiveness and feasibility of the DA are evaluated on the IEEE 69-bus radial system. The results show the effectiveness of the proposed algorithm.

**Keywords:** Renewable Distributed generators, Distribution network, Meta-heuristic algorithm, Voltage-dependent load model.

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**WEEME'24-435-Ps**

**Numerical Investigation of Very Low Reynolds Octagonal Jet for Personalized Ventilation**

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**Abstract: Due to the wide spread of diseases and viruses in the last years, researchers focused their researches to prevent the spread of diseases and viruses among people. For building researches,** personalized ventilation (PV) has been highly relied by indoor environment researchers, especially for collective spaces that uses mixing ventilation (MV) such as office room, class room, meeting room, and library. The (PV) method has been used for decades in transportation environments such as airplanes or automotive…ect, before adopting it for building ventilation. In this numerical investigation, the computational fluid dynamics (CFD) mimic solving the governing equations using the commercial ANSYS Fluent software, modeling a very low Reynolds octagonal jet, to obtain the appropriate mesh density it has been tested five different mesh densities, this study aims to enhance the personalized ventilation in indoor environment by driving clear fresh air to each occupant breathing zone, as well as enhancing the thermal comfort in their microenvironment, with less energy consuming by supplying a very low inlet airflow (very low Reynolds number) through 8 lobes orifice, the results showed that the octagonal jet extends to a far distance from the orifice which reaches to the occupant's face (breathing zone), whereas ensures a pure fresh air for the occupant, as well as reducing diseases spread among the occupants in indoor environment, all that with less energy consumption for diseases prevention and ventilation application, furthermore this system can be emplaced on the desk or on the office table...

**Keywords:** Numerical investigation, Personalized ventilation, Very low Reynolds, Octagonal jet, 8 Lobes orifice

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**WEEME'24-436-Ps**

**Optimization of photovoltaic PV using a new control strategy for renewable energy**

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**Abstract:** To increase the power output of a PV module or a field of PV modules, an electronic controller is incorporated between the PV generator and the load, whose role and main objective

is the continuous monitoring of the maximum power point of the PV generator commonly known as MPPT (Maximum Power Point Tracking) and this in general per action on a DC-DC conversion device. The new technical algorithm based on Neural Networks, is designed to be more robust in performance with respect to tracking speed and precision for renewable energy. Moreover, this new successful technical research, provides a robust neural structure compared to the noisy empirical data used for the prediction of the command. Consequently a smooth control signal without oscillation, targeting exactly the expected optimal control with an independent control of the sampling frequency of the system. The regulation and control techniques provide the impedance matching function, transferring to the load the maximum electrical power output from the PV generator in any the temperature and sunshine conditions. The development of a revolutionary method based on neural algorithms for the prediction of an instantaneous command is the main objective in our work. Indeed, the paper presents a new control strategy for the photovoltaic PV, it is a command based on Neuronal Network technique. It is the first time that this technique has been introduced, and proposed by the authors in synthesizing control laws for the converters of electronic power. The robustness of the networks of neurons opposite the noise of measurements, like, the smoothness of the power signal of PV system generated during the application of the neuronal order, will qualify this command as a practical alternative to the disadvantages recorded on the levels of the classical methods. This study, which is followed by a simulation, has enabled us to consolidate the idea that the new Neural Network controller when compared to their classical counterparts, and obtains the best performances concerning the speed of tracking and precision.

**Keywords:** Renewable energy, energitic transition, photovoltaic PVNeural networks; Algorithm of Levenberg- Marquart; New technique;

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**WEEME'24-437-Ps**

## Modeling of a PV system with different MPPT techniques using MATLAB/Simulink and Implementation in Arduino of MPPT Using P&O, InC Algorithm

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**Abstract:** To maximize the electricity output of a photovoltaic generator (PVG), maximum power point (MPPT) detection methods are most commonly used in photovoltaic systems. The principle of these techniques is to operate the PVG at maximum power (MPP), which depends on environmental factors, such as solar radiation and ambient temperature, and ensures optimal power transfer between the PVG and the load. In this article, we present the implementation of digital MPPT commands using the Arduino Mega type. The two proposed MPPT controls are based on the perturb and observe algorithm (P&O), InC, Fuzzy logic, PID based on PSO. The simulation results show that the Fuzzy logic controller provides good results and is the most efficient compared to the P&O, InC and PSO based PID algorithm. As the experimental results show, the P&O and InC algorithm give good results

**Keywords:** photovoltaic, P&O and InC algorithm

**WEEME'24-438-Ps**

## Power Quality Enhancement of Grid Connected Brushless Doubly-Fed Induction Generator Using Robust Fuzzy Logic Algorithm

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**Abstract:** This paper deals with a Robust fuzzy logic control algorithm designed for grid-connected brushless doubly fed induction generator (BDFIG) based wind energy conversion systems (WECSs). The developped control system is based on decoupling control using oriented grid flux vector control strategy. However, a decoupling between active and reactive stator powers is carried out to abotain an optimal performance of the BDFIG at sub-synchronous region. Althoug, the control allows keeping the stator power factor at unity. The power controller is an optimized fuzzy logic algorithm that insures the achievement of the required behavior. In addition, a maximum power point tracking strategy is included as an additional solution to enhance and improve the wind energy conversion system efficiency.

**Keywords:** Brushless Doubly Fed Induction Generators (BDFIG) Wind Energy Conversion Systems (WECSs), Fuzzy logic Control

**WEEME'24-440-Ps**

## Modeling and simulation of five-phase Permanent Magnet Synchronous Generator Used in Wind Energy Conversion System with variable speed wind turbine

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**Abstract:** In this work a comprehensive analysis of a wind turbine/generator drive system (WTGD) using a multiphase variable speed AC generator is considered. Although in the field of renewable energy the doubly-fed induction generators are extensively discussed for the WTGD applications, the five-phase permanent magnet synchronous generators (FP-PMSG) have prehended considerable focus too. This traceable to their noteworthier high efficiency and reliability, increased power levels, and higher torque pulsations. Furthermore, the use of multi-pole FP-PMSG is suitable for the direct driven wind turbine applications offering a high performance for the standalone WTGD applications. Due to the fact it eliminates the need for the mechanical gearbox and less maintenance requirements, hence les mechanical parts. This implies a reduction in the friction forces, the nacelle's weight, and the system's full-scale cost. Thus, in this work a mathematical modelling and analysis of the different parts constituting the WTGD, the speed of the wind, wind turbine, drive train, and the FP-PMSG, that explains the system's behaviour. In addition to, a simulation study of the conversion system in the MATLAB/Simulink environment to evaluate the direct driven WTGD system

performance under different simulation scenarios in terms of current THD content, disturbance rejection under different loading and wind speed conditions.

**Keywords: FP**-PMSG, wind turbine, MATLAB, simulation, modeling, energy conversion system, renewable energy

**WEEME'24-101-Ps**

### Advanced Hydrogeological Modeling of the Miocene Aquifer in the El Malabiod Region, N.E. Algeria Using VISUAL MODFLOW Flex: Strategies for Sustainable Water Management

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**Abstract:** The El Malabiod region, located in the far east of Algeria with a semi-arid climate, is experiencing severe drought. The area has been heavily affected by the overexploitation of its water reserves, particularly the Miocene aquifer that supplies the local drinking water. Compounding the issue, climate change has led to reduced precipitation, increased temperatures, and higher evapotranspiration rates, resulting in a significant drop in the aquifer's piezometric levels. Our research aims to reconstruct the groundwater piezometry using Visual MODFLOW Flex software and employ the finite-difference method to predict future flow conditions. In the second phase of our study, we will simulate groundwater flow from 2024 to 2034 using a 3D transient numerical model with the same software. We will explore various scenarios, including maintaining current pumping rates without recharge and introducing artificial recharge through surface water infiltration basins. Additionally, we will assess the effects of effective infiltration across the entire study area with no pumping.

**Keywords:** El Malabiod, VISUAL MODFLOW Flex, Overexploitation, Piezometric levels, Miocene aquifer, Artificial recharge

## Mechanics and Emerging Technologies & Materials Engineering

**WEEME'24-206-Ps**

### Calculation of radial distribution functions in hydrogen plasma using modified G. Kelbg potential

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**Abstract:** In this work we will attempt to calculate the radial correlation distribution functions in plasmas, taking into account the quantum effects that are usually neglected when using Debye interaction between ions. For this purpose the analytical calculations have been used. The proposed potential of G. Kelbg with some minor modifications has been used. These modifications are based on introducing the screen effect to this interaction. The followed steps to simplify Kelbg interaction have been presented. Based on the latter, the radial distribution functions have been calculated. The

results of this modified potential have been compared with other potentials results. Most of our results were in agreement with those of the other potentials.

**Keywords:** quantum effect, plasma, G. Kelbg potential, radial correlation function

**WEEME'24-207-Ps**

**The ionic electric microfield distribution functions of one component plasma (OCP) governed by screened G. Kelbg potential**

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**Abstract:** In this work, a brief on Monte Carlo (MC) simulation has been exposed. this latter has been used to calculate the microfield distribution functions for a single component plasma considering a modified screened and non-screened G. Kelbg potential. The results have been compared with those of other potentials. The most of our results were agreed with them.

**Keywords:** Plasma, G. Kelbg potential, Monte Carlo simulation, microfield distribution function

**WEEME'24-326-Ps**

**Influence of HDPE on The Stiffness Modulus of Asphalt Concrete Based on Dune Sand**

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**Abstract:** This study investigates the potential of using dune sand, abundant in southern Algeria, as a substitute for crushed sand 0/3 in asphalt concrete mixes. Due to the scarcity of conventional aggregates in the region, this approach offers a cost-effective solution for road infrastructure. To enhance the performance of dune sand-based asphalt concrete, High Density Polyethylene (HDPE) was added into the bitumen using a wet method. The research focused on analyzing the impact of High-Density Polyethylene addition on the mechanical characteristics of the asphalt concrete, particularly its stiffness modulus. The optimal composition determined by the Marshall test was maintained for Indirect Tension (IT-CY) test conducted at varying temperatures and stresses. Results demonstrated that HDPE addition significantly improved the mechanical performance of the asphalt concrete, particularly with the inclusion of 1% HDPE. The enhanced stability and stiffness modulus of the modified mix, compared to conventional asphalt concrete, indicate its potential for improved durability and performance in road applications. This research provides valuable insights for developing cost-effective and sustainable road infrastructure solutions in regions with limited conventional aggregate resources.

**Keywords:** Asphalt, Stiffness modulus, HDPE, Marshall Test, Dune sand.

**WEEME'24-327-Ps**

**A Review study on Physico-Mechanical Properties and Durability of Lime Mortar Based on Recycled Materials**

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**Abstract:** Given its availability, its lower price compared to cement and its reputation as an environmentally friendly material, the use of lime in construction is an extremely important alternative. In addition to its good workability and its interesting thermal comfort capacity, lime can offer considerable performances and solve many environmental problems. To overcome the mechanical shortcomings and the low durability of lime mortar, numerous attempts, dating back to earlier times, have been made by adding additives, particularly organic additives and natural fibers. Currently, additives of different natures (natural or artificial) can be used to produce cheaper, efficient and durable lime mortar. This paper will present a literature review on the different properties of lime mortar based on recycled materials. Several studies characterizing mortars made from a mixture of hydraulic lime and sand with additives derived from natural or artificial residues will be examined. Research dealing with the incorporation of metakaolin and various types of additives, as well as their influence on the physico-mechanical behavior and durability of lime mortar, will also be presented in this paper.

**Keywords:** Lime, Dune sand, Mortar, Additives, Recycling, Physical properties, Mechanical strength, Durability

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**WEEME'24-329-Ps**

## Study the fluctuation at the W2A' station using OLGA simulator

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**Abstract:** The exploitation of gas or liquid HCs comprises a series of expensive successive steps among these steps, the piping of fluids from the producing wells to the Treatment facilities. At the beginning of the field exploitation, the well pipeline operated with a normal capacity capable of receiving production from the field. After 40 years, a drop in reservoir pressure, with an increase of GOR has caused many problems in the network. The main problem of the pipeline system in the field of Hassi Messaoud is to be able to receive this gas production without impacting the oil production. This study has a well-defined aim which is creation of a wells network to optimize production and to determine eventually all possible scenarios. This work aimed to study the case of the separation station of W2A' and to find the optimum solution to solve the fluctuation problem at this station. Based on the OLGA's simulation results we concluded that the most convenient and economical solution is to install a separation and boosting station at the manifold HGA.

**Keywords:** OLGA, W2A', HGA, separation, fluctuation, simulation.

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**WEEME'24-332-Ps**

## Dielectric behavior of PLLA films during dynamic crystallization and effect of vacuum annealing

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**Abstract:** The present study investigate the dielectric behavior during dynamic crystallization of amorphous poly-L-lactic acid (PLLA), and the effect of vacuum thermal annealing. The dielectric strength increases with an onset shifted to higher temperature with increasing the frequency. The dynamic crystallization is achieved upon a broad peak ranging from 340 to overhead 425 K. The α-relaxation peak was found to be shifted to higher temperature with increasing the frequency, due to the suppression of long-range motions. The apparent activation energy for the molecular mobility is ~263 kJ/mol at higher frequencies. PLLA films exhibit a good optical transmittance in the visible region above 80%, which decreases significantly (~38% after 1 h) with vacuum annealing. The infrared spectra showed the characteristic bands of PLLA and revealed that the removable of $H_2O$ becomes more efficient with increasing temperature under vacuum annealing. The nucleation of the molecular chains is initiated by the thermal energy, and it is marked with a decreases in the broadening alongside with the appearance of a new band nearby 920 $cm^{-1}$ Ë.

**Keywords:** PLLA films; α-relaxation; Vacuum annealing; $H_2O$ removable; Optical transmittance.

**WEEME'24-333-Ps**

## Efficacy of Ag-Zeolites as a Fungicide: A New Approach

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**Abstract:** This study highlights the economic and agricultural importance of citrus fruits (1), particularly lemons, as well as the challenges posed by post-harvest diseases, notably green mold caused by Penicillium digitatum. These diseases lead to significant economic losses worldwide due to their ability to spread rapidly after harvest. The study's objective is to identify the conditions favorable to these infections and to evaluate effective control and prevention methods. Two methods of applying Ag-Zeolite-based antifungal agents were compared on lemons infected with P. digitatum (2). The results revealed significant differences in the effectiveness of the tested methods. In the first method, lemons were wounded and soaked in Ag-ZSM-5 zeolite solutions at different concentrations (1% and 2% silver) (3). At 1%, half of the fruits showed signs of decay after six days, while at 2%, most lemons remained firm, though a few showed signs of decay. The second method involved artificially inoculating lemons with P. digitatum and applying Ag-ZSM-5 zeolite suspensions to the wounded fruits. The results showed that the treated lemons had a significant reduction in decay compared to the untreated controls. The results underscore the importance of specific zeolite characteristics, such as their structure and silver release capacity, in their effectiveness against post-harvest fungal infections. However, signs of phytotoxicity, such as black spots on the lemon skin, were observed, indicating the need to balance antifungal efficacy with the impact on fruit quality. Among the two methods tested to control green mold caused by Penicillium digitatum on lemons, the most effective method appears to be the first, which involved soaking the wounded lemons in Ag-ZSM-5 zeolite solutions at different concentrations. This method showed that at a 2% silver concentration, most lemons remained firm with only a few signs of decay after six days. In contrast,

the second method, which involved artificially inoculating the lemons and applying Ag-ZSM-5 zeolite suspensions to the wounded fruits, while effective, did not surpass the results obtained with soaking. Thus, the soaking method with 2% Ag-ZSM-5 seems to be the best in terms of preventing decay while minimizing signs of phytotoxicity.

**Keywords:** Ag-zeolites, post-harvest, fungicides, Penicillium digitatum.

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**WEEME'24-334-Ps**

### Thermal Buckling analysis of Functionally graded material beams

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**Abstract:** This paper aims to investigate the thermal buckling behavior of functionally graded material (FGM) beams using a novel two node finite element based on enhanced Timoshenko beam theory. Unlike other high order theories, this element employs only three degrees of freedom per node, simplifying the analysis. The model incorporates a quadratic shear stress distribution across the beam thickness, ensuring zero shear strain at the top and bottom surfaces without requiring a shear correction factor. The total potential energy principle forms the basis for deriving the stiffness and geometrical matrices. The material properties are considered to vary according to the power law distribution. The effectiveness and accuracy of the model are demonstrated through convergence and comparison studies, which show its reliability in predicting the critical temperature rise for buckling behavior of Functionally graded material beams. The influence of volume fraction and length to thickness ratio on the buckling behavior is also examined. This work provides valuable insights into the thermal buckling characteristics of FGM beams, contributing to the advancement of design and analysis methods for these innovative materials.

**Keywords:** Functionally graded materials, Buckling behavior, thermal, Finite element.

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**WEEME'24-335-Ps**

### The Effect of Zinc Doping Levels on Cobalt Oxide produced by Spray Pyrolysis Using a Solar Concentrator

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**Abstract:** This study investigates the synthesis of zinc-doped cobalt oxide ($Co_3O_4$) thin films using the spray pyrolysis technique with a solar furnace. Zinc doping levels were varied at 0%, 2%, and 4% to explore their impact on the structural, morphological, optical, and electrical properties of the resulting films. X-ray diffraction (XRD) revealed phase changes and lattice distortions due to zinc incorporation. Scanning electron microscopy (SEM) showed morphological variations correlated with doping levels. UV-Vis spectroscopy was employed to analyze the optical properties, revealing a shift in the band gap with increased zinc content. Electrical conductivity measurements indicated that zinc doping significantly influences the charge carrier dynamics in $Co_3O_4$ films. These findings suggest potential applications of Zn-doped $Co_3O_4$ in energy storage and gas sensing devices.

**Keywords**: Co3O4, Thin films, x-rays, optical gap, spray, solar.

**WEEME'24-337-Ps**

**Temperature Monitoring in Machining Using Infrared Technology**

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**Abstract:** This article presents an in-depth study of thermal monitoring in machining using an infrared sensor to measure cutting temperature during turning operations. The objective is to assess the influence of cutting parameters - including cutting speed, feed rate, and depth of cut - on the temperature generated in the cutting zone, a crucial factor for workpiece quality and tool life. The use of infrared sensors enables precise, real-time data collection, providing deeper insights into the relationship between cutting conditions and the thermal behavior of the process. The findings illustrate how optimizing cutting parameters can reduce thermal impact and improve machining process efficiency.

**Keywords:** Cutting temperature, Monitoring, Cutting Parameters, Measurement, Turning

**WEEME'24-338-Ps**

**Impact of Nanosilica on the Diffusion of Phenolic Antioxidants in LDPE Matrices**

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**Abstract:** The migration of additives from packaging materials into food represents a significant public health risk. When the concentration of these additives exceeds legal thresholds, many exhibit toxic effects, making their use in packaging a regulatory concern and a potential hazard for consumers. To mitigate additive migration, strategies such as using high molecular weight additives and incorporating nanosilica fillers into the polymer matrix have been explored. This study examines the effect of nanosilica on the diffusion of a high molecular weight phenolic antioxidant, Irganox 1010, within two LDPE matrices (pure LDPE and LDPE with 1% nanosilica). The diffusion behavior was analyzed using the Roe model. Results indicate that the diffusion of Irganox 1010 in pure LDPE is relatively slow, with a diffusion coefficient of $Dp=1.69\times10^{-12}$ cm²/s at 23°C. The incorporation of 1% nanosilica further reduces this diffusion, with the coefficient decreasing to $Dp=9.94\times10^{-13}$cm²/s. Additionally, the activation energies associated with the temperature-dependent diffusion process, as described by the Arrhenius equation, are significantly high. The activation energy is 94.23 kJ/mol for pure LDPE and increases to 100.09 kJ/mol with the addition of 1% nanosilica.

**Keywords:** Nanosilica, LDPE, Irganox 1010, diffusion, packaging films, toxicity.

**WEEME'24-341-Ps**

**Optimization of Burnishing Parameters for Enhanced Machined Surface Finish Quality**

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**Abstract:** This study focuses on the prediction and optimization of key burnishing parameters to improve surface finish quality. The primary objective was to understand how factors such as rotation speed, feed rate, and depth of cut impact surface roughness and to establish optimal settings for superior results. Findings indicate that carefully optimized parameters can significantly enhance surface quality, with roughness reductions of up to 30% observed by increasing the depth of cut, while higher rotation speeds led to roughness increases of around 20%. By positioning burnishing as a viable alternative to grinding, the research achieved an average roughness reduction of approximately 25% using optimized parameter settings on a lathe-mounted burnishing tool. These results underscore the potential of burnishing as an effective, versatile technique for industrial surface finishing, offering predictive insights and optimization strategies for achieving high-quality machining outcomes

**Keywords:** Burnishing, Ball burnishing, surface roughness, surface finishing, plastic deformation.

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**WEEME'24-343-Ps**

## Morphology Properties of $Fe_2O_3$, Dope aluminum (AL) Thin Films Deposited by Spry Pyrolysis

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**Abstract:** Transparent thin films of α-Fe2O3 have been deposited on glass substrates and aluminum doped by chemical spray pyrolysis (SPMN) technique using solution of aqueous iron chloride (FeCl3) at 350 C°. surface morphology, properties were investigated post-deposition annealing. Scanning electron microscopy (SEM) was used to investigate the surface morphology of Al-doped iron oxide thin films (Al-α-Fe2O3) with varying doping concentrations (0%, 2%, 4%, 6%, 8%, and 10%) The SEM images reveal a homogeneous distribution of grains.

**Keywords:** spray Pyrolysis, thin films, iron oxides, hematite, doping

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**WEEME'24-344-Ps**

## First principles study of Structural, Stability, and Elastic properties of Lanthanum dihydride system

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**Abstract:** As an environmentally beneficial substitute for fossil fuels, hydrogen is a renewable energy source. To use hydrogen as fuel, a hydrogen storage system needs to be sufficiently efficient to have a high storage density, a low ad/desorption temperature, and good reversibility. Rare earth (RE) alloys are viewed as promising materials due to their high hydrogen capacity per volume unit and their ability to absorb hydrogen easily at moderate temperatures and pressures. The aim of this research is to study theoretically structural, stability, and elastic properties of lanthanum dihydride

by the first principles calculations based on density functional theory using the WIEN2K ab-initio simulation package at 0K with the generalized gradient approximation of the Perdew-Burke-Ernzerhof functional and local density approximation to determine the exchange-correlation interaction energy. The equilibrium geometries, formation energy, elastic constants, Poisson's ratio, various moduli, elastic wave velocities, Debye temperature, and melting temperature were systematically studied. It was concluded that the GGA optimized lattice parameter and formation energy agree much better with the experimental findings than the LDA one. The computed elastic constants indicated that this dihydride is mechanically stable in both GGA and LDA. Further, the shear and Young modulus, as well as the Poisson ratio, suggest that the compound is brittle. The predicted Debye temperature value by GGA is in agreement with the theoretical value. Due to its high melting temperature, it can be used at high temperatures.

**Keywords: Hydrogen storage, density functional theory, Elastic properties, FP-LAPW**

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**WEEME'24-345-Ps**

## Correlation Between Vickers Hardness and Strength Indices in HSLA Steels for Pipeline Applications

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**Abstract**: The reliable transportation of gas through pipelines over their operational lifespan—a primary objective for pipeline designers and operators—depends significantly on the proper implementation of design specifications during construction. Ensuring dependable pipeline performance requires adherence to strict manufacturing and installation requirements for the pipes. Mechanical testing of base and weld metals is conducted to validate pipeline performance under operational conditions, as mandated by standards such as API 5L. It is well-recognized that mechanical properties like yield strength and tensile strength can often be predicted using material hardness values, a practice widely employed in the industry. This study focuses on establishing and analyzing the correlation between strength parameters and Vickers hardness for high-strength low-alloy (HSLA) steels commonly used in long-distance gas pipelines. Using multiple linear regression analysis, models were developed to describe the relationship between tensile properties and hardness measurements. A stepwise method was applied to identify the most accurate models, minimizing prediction errors for tensile property estimation.

**Keywords**: HSLA steels, pipeline, mechanical properties, multiple regression.

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**WEEME'24-347-Ps**

## Influence of Chemical Extraction Methods Using NaOH on Mechanical Properties of Yucca Natural Fibers: A Comparative Study of 2%, 6%, and 12% Concentrations During 3 Hours.

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**Abstract:** This study explores the influence of sodium hydroxide (NaOH) extraction on the mechanical properties of Yucca natural fibers, focusing on three distinct NaOH concentrations (2%, 6%, and 12%) applied over a 3-hour period. The aim was to assess how varying concentrations of NaOH, as a chemical extraction method, affect the tensile strength, X-ray results, and overall structural integrity of the fibers. Tensile testing revealed a significant decrease in the mechanical strength of Yucca fibers with increasing NaOH concentration: around of 550 MPa for the 2% NaOH extraction, 480 MPa for the 6% NaOH extraction, and 265 MPa for the 12% NaOH extraction. This progressive decline in tensile strength suggests that higher NaOH concentrations enhance the extraction of soluble lignocellulosic components, such as hemicellulose and lignin, which contributes to a reduction in the fibers' mechanical performance. Additionally, the crystallinity index (CI) was measured for each extraction methods using X-ray machine, showing values of 65.3, 62.7, and 55.9% for the 2%, 6%, and 12% NaOH extractions, respectively. These findings demonstrate the significant role of NaOH concentration in modulating the mechanical properties of Yucca fibers during chemical extraction. The results suggest that while higher NaOH concentrations increase the extraction efficiency of lignocellulosic materials, they also compromise the mechanical integrity of the fibers. These insights are valuable for optimizing extraction processes for natural fibers, particularly in applications such as bio-composites, textiles, and other industries requiring high-performance materials.

**Keywords:** Yucca fibers, NaOH extraction, mechanical properties, tensile strength, natural fibers, chemical extraction.

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**WEEME'24-348-Ps**

## Impact of Activated Carbon on the Performance of an Adsorption Refrigeration Cycle with Methanol

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**Abstract:** Due to the global drive towards sustainability, adsorption refrigeration, and heat pump, systems have witnessed a surge in interest in recent decades. These systems leverage environmentally friendly adsorbent materials and safe refrigerants, operating efficiently through solar heat, thus embodying a sustainable technology. Among modern applications, adsorption cooling systems are particularly prominent. This study examines the influence of activated carbon mass with adsorbed methanol at adsorption temperatures ranging from 80 to 110 °C, with an evaporation temperature of 0 °C and a condenser temperature of 30 °C. The Dubinin-Astakhov (D-A) models were employed to correlate the experimental data and construct a diagram for the utilized pair. The study yields the following coefficients of maximum performance (COP): 0.50, 0.52, 0.53, 0.54, and 0.55. Additionally, the obtained heat during the adsorption phase (Qads) is: 459.4, 536, 612.53, 689, and 765.66 kJ, and the evaporation heat (Qev) are: 382.5, 446.25, 501.0, 573.75, and 637.5 kJ, corresponding to activated carbon masses of 1.5, 1.75, 2, 2.25, and 2.5 kg, respectively. The results indicate a strong correlation between the mass of activated carbon and the system's cooling

capacity, suggesting that an increased mass of activated carbon enhances the cooling effect. Future research will focus on evaluating the required adsorption pairs for heating applications under varying environmental conditions.

**Keywords:** Adsorption heat; Evaporator heat; Dubinin-Astakhov; Activated Carbon

**WEEME'24-349-Ps**

## Investigating the Influence of Activated Carbon Adsorption Capacity on water-Based Adsorption Refrigeration Cycles

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**Abstract:** In recent decades, there has been a surge of interest in adsorption refrigeration and heat pump systems. These systems utilize environmentally friendly adsorbent materials and refrigerant pairings and are powered by sun heat, making them a sustainable and efficient technology. Adsorption cooling systems are among the important systems in modern applications. this study aims to find out the effect of activated carbon mass with adsorbed water over adsorption temperatures ranging from 70 to 110 °C, and evaporation temperatures 0 °C. Dubinin-Astakhov (D-A) models are used to correlate the experimental data and to draw a diagram of the assorted pair. The study results in the coefficient of max performance (COP) of the system are 0.44, 0.48, 0.51, 0.52, 0.54, and the evaporator heat amount (Qev) of 252, 378, 503, 629, and 755 kJ/kg. Also the desorption heat amount (Qds) of 316, 474, 632, 790, and 948 kJ/kg with the change in mass: 0.5, 0.75, 1, 1.25, and 1.5 kg of activated carbon, respectively. The results also show that the mass of activated carbon in the mixture has a significant effect on the cooling capacity. Furthermore, these results can be considered important in applications that will be used in the future

**Keywords:** Activated Carbon; Coefficient of performance; Cooling Energy; Desorption;

**WEEME'24-350-Ps**

## Elastic anisotropy and mechanical stability of ScAuGe: First-principles investigation

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**Abstract:** ScAuGe is an experimental intermitalic that order nomagnitic in a hexagonal $CaIn_2$-type structure, exhibiting remarkable physical properties, especial. Numerous experimental studies have already uncovered important aspects of its physical behavior, while several properties remain unexplored. For the first time, first-principles calculations were performed to investigate its structural, and elastic properties. These investigations were conducted using the FP-LAPW method with the generalized gradient approximation (GGA), implemented in the WIEN2k code .The study begins with structural properties, This compound have internal atomic positions, for this we started by relaxation, after that and by this result we do the optimization (The totale energy a function of volume ).The elastic stiffness constants $C_{ij}$ were then calculated,along with the bulk modulus B,shear modulus G,Young's modulus E, and Poisson's ratio v,using the Voigt–Reuss–Hill approximation.The elastic constants $C_{ij}$ can be used to study additional properties of this compound,particularly elastic

anisotropy,which was further examined using the theoretical model of J. Nordmann et al.Mechanical anisotropy was analyzed through several anisotropy indices and three-dimensional (3D) surface constructions.

**Keywords:** ScAuGe, FP-LAPW, nomagnetic, Elastic anisotropy.

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**WEEME'24-351-Ps**

### The Production of Ecological Gasoline That Complies with New Environmental Requirements at The Southern Industrial Complex in Hassi Messaoud Algeria)

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**Abstract:** The Objective of this research is to develop an environmentally friendly gasoline that complies with the international environmental standards established by the European Commission (EURO V). To accomplish this, the simulation software ASPEN HYSYS V12.1 was employed, utilizing the alkylation reaction between iso-paraffins and olefins derived from gas sources. The resultant simulated alkylate, labeled as ecological gasoline, is designed to completely eliminate aromatics and benzene while increasing the octane rating. This innovation not only meets stringent environmental guidelines but also paves the way for Algeria to export of high quality gasoline to international markets, thereby positioning itself as a significant contender in the global energy sector.

**Keywords:** Alkylation, EURO V, Aromatic, ASPEN HYSYS, Gasoline, Octane Rating, Benzene.

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**WEEME'24-353-Ps**

### An Investigation into the Influence of AL2O3/water and CU/water Nanofluids on Laminar Flow Forced Convection in a Double Backward-Facing Step

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**Abstract:** Nanofluids are instrumental in managing the thermal performance of electronic devices due to their superior heat transfer properties. The incorporation of nano-sized particles within these fluids significantly enhances thermal conductivity, making them effective cooling agents for electronic components. This technology is vital for mitigating overheating and ensuring the optimal performance of electronic devices. This paper presents a numerical investigation of heat transfer using Cu/water and $Al_2O_3$/water nano-fluids in a double backward-facing step configuration. The study examines two different nanoparticle volume concentrations (4% and 5%) and investigates Reynolds numbers between 100 to 400, with an inlet temperature of 300 K and the lower hot wall temperature of 340 K. The governing equations continuity, momentum, and energy are analyzed by using the finite volume method based on the SIMPLE algorithm in a two-dimensional. The performance of the heat transfer characteristics is evaluated based on several parameters, including the heat transfer coefficient, thermal conductivity, Nusselt number, The results demonstrate that the addition of nano-fluids enhances the thermal performance within the channel. Comparative

analysis reveals that Cu nanofluids exhibit superior enhancement in Nusselt number and heat transfer rates compared to $Al_2O_3$ nano-fluids. Additionally, increasing the number of steps improves the Nusselt number on the downstream wall of the steps and shifts the peak Nusselt number position forward. Among the factors affecting the Nusselt number, flow velocity has the most substantial impact on the lower wall of the step, followed by the step expansion ratio and the increase in the second step.

**Keywords:** Nanofluid, Forced Convection, Heat Transfer, $AL_2O_3$, CU, Double Backward-Facing Step

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**WEEME'24-208-Ps**

## The Electric Microfield and its Spatial Derivatives Distribution Functions Through G. Kelbg Potential: an Application on Lyman-α Spectral Line Shape of plasma $Li^{+2}$

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**Abstract:** In The electric microfield distribution functions were computed using Monte Carlo simulation (MC). To achieve this, the G. Kelbg interaction, which accounts for quantum effects at short distances, was employed. In the simulation, all interactions between plasma components were fully accounted for. Additionally, the spatial derivatives of the microfield distribution functions were analytically derived, using the independent particles model (emitter-perturber). These functions and their spatial derivatives were then incorporated into the calculation of the spectral line shape $Ly-\alpha$ of the pure plasma $Li^{+2}$.

**Keywords:** kelbg potential, electric microfield, the spatial derivatives, simulation, the spectral line shape $Ly-\alpha$

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