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Conference and Forum on Engineering Science

JSI'2022 is a leading conference and forum on Engineering Science. During this event, conferences relating to the considered areas are presented in the form of plenary sessions and oral communications by researchers, industrials and students. The subject areas include, but are not limited to the following fields:

-Innovation and industrial applications,
-Engineering technology,
-Agroindustry development,
-Energy efficiency,
-Renewable energy,
-Sustainable environment,
-Modelling and simulation,
-Experimental testing methods,
-Industry 4.0.

This scientific conference JSI'2022 has been organized in the National School of Engineers of Sfax (ENIS) of the University of Sfax with the support of the Laboratory of Electromechanical Systems, the Association of Engineers from National School of Engineers of Sfax (AIDENIS), the Tunisian Engineers Order (TEO) and the Club of Mechanics (CM). The goal is to contribute to the welfare of technology exchange and to create a fruitful environment between researchers and industrials to create the closer contacts and sharing experience in various engineering sectors.

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Editorial

On behalf of all members of the Organizing and Scientific Committees of the Conference on Engineering Science (JSI'2022), it is an honor for us to welcome all of you in Sfax, TUNISIA. As you will have the opportunity to see, Sfax is a nice city in board of the Mediterranean Sea.

This scientific conference JSI'2022 has been organized in the National School of Engineers of Sfax (ENIS) of the University of Sfax with the support of the Laboratory of Electromechanical Systems, the Association of Engineers from National School of Engineers of Sfax (AIDENIS), the Tunisian Engineers Order (TEO) and the Club of Mechanics (CM). The goal is to contribute to the welfare of technology exchange and to create a fruitful environment between researchers and industrials to create the closer contacts and sharing experience in various engineering sectors.

The Conference on Engineering Science (JSI'2022) is aimed to concretize these objectives and intended to attract the interest of specialists, academicians and researchers from the international community working in areas related to engineering science. Improvements have been made to this version by adding the Industrial Forum to give more opportunities for technologists and industry to participate in this conference.

The conference will to bring together innovative academics and industrial experts in the fields of engineering science to a common forum and to cater sessions on these fields, thus enabling even greater interdisciplinary knowledge sharing.

It is devoted to all innovative aspects and experimental methods used in the fields of engineering science. Its aim is to bring together leading researchers who are interested in experimental and also theoretical work in these fields to initiate more careful consideration of these issues and to meet the share cutting-edge development in these areas.

During the three days of the scientific conference, more than 80 scientific and technical papers concerning these subjects, made for about 197 authors coming from North Africa as well as from the others continents, will be presented and 16 keynote talks will be held, in parallel sessions. The conference offers an exceptional opportunity to assess the state-of-the-art of engineering science and its potential for future applications with different sessions covering the following topics:

-Innovation and industrial applications,

-Engineering technology,

-Agroindustry development,
-Energy efficiency,
-Renewable energy,
-Sustainable environment,
-Modelling and simulation,
-Experimental testing methods,
-Industry 4.0.

Finally, we wish to express our gratitude for all your help in the results of the Conference. A sincere thankfulness should be addressed to the Ministry of High Education and Scientific Research, the university of Sfax, the National School of Engineers of Sfax, the Electromechanical System Laboratory and all others sponsoring institutions who have actively, financially and morally contributed to the organization of the conference among academic, scientific and industrial communities. Our thanks are also due to Municipality of Sfax and the regional delegation of culture.

At last, but not least, the Organizing Committee of the Conference is very recognized to all of you, members of the International and Tunisian Committees, contributors, speakers, chairpersons and all of our local assistants, for giving an international prestige to the Conference, as well as for the good work accomplished.

We hope that you all find an enjoyable environment for exchange of ideas and satisfying conditions to follow all the sessions of the conference that of interest to you. As you were informed in the site web of the conference, the selected papers will be presented to publish in different international journals and Books covering the general areas of engineering science.

Once again, you are welcome to the conference.

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Keynotes

Biodiesel production from waste frying Oil: Optimisation, Characterisation and application

Soumaya Bouguerra Neji[1], Mariem Harabi[1], and Mohamed Bouaziz[1,*]

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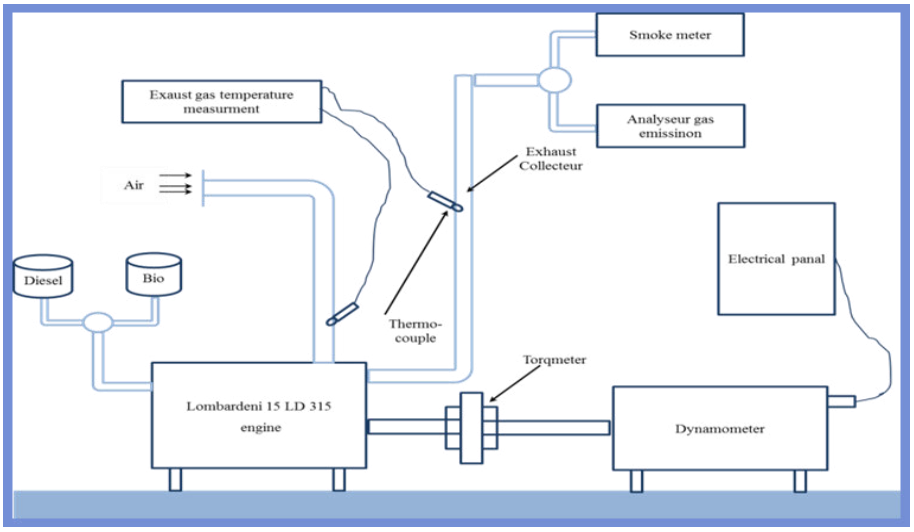
Abstract: Waste oils are becoming an increasingly important raw material in the production of fuels. Optimisation of the homogeneous transesterification of frying oil (WFO) into biodiesel over the potassium hydroxide catalyst (KOH) has been studied by the Surface Response Method (RSM). The physicochemical properties of optimized biodiesel met therequirements of the European Norm 14214.Tests on diesel engines have been successfully applied

Keywords: Waste frying oil; Biodiesel; Transesterification; Optimisation; Motor Diesel.



Graphical abstract

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Numerical static and dynamic analysis of continuum mechanical plate structures using finite element models at different boundary conditions

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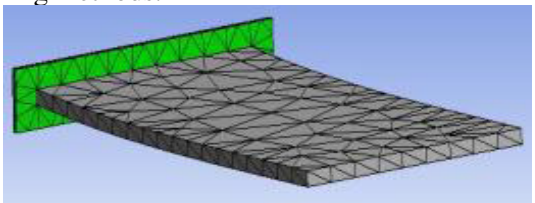
Abstract: Discrete and continuum mechanical structures are actually of great importance in the new technology fileds, especially in mechanical industries, aeronautics, civil engineering and biomechanics. During their time life, they are often subjected to considerable external forces or very high amplitudes of vibrations which can cause them large deformations and important internal stresses that can cause them to internal cracks or even their total destruction. In order to avoid such problems, theoretical and numerical modeling analysis is necessary for eventual design and concept at static or dynamic states of these structures is recommended. In fact and du to their complexity and dimension, these stuctures can be modeled as continuum ones with specific mechanical properties. Our work consists on static and dynamic analysis bi-dimensional plate structures with two different different boudery conditions i.e: clamped-free and clamped-clamped conditions, based on numerical mathematical model using plate finite elements. The element mass matrix is determinated based on the inertial forces due to the mass of the element equivalent plate inertia forces applied to the nodes and the stiffness matrix elemnt is obtained based on the strain energy deformation of the deformed element. The total mass and stiffness matrices of the all plate structure can be obtained by assembling all the plate elements. The reaction forces at the boudery conditions, the nodal displacements and the different normal and tangential stresses at each element are determinated. Also the natural frequencies, the eigenvalues and eigenvectors for both plate structures are calculated. For both cases, the obtained results using our developed program are very acceptable compared to those obtained using existing program such as software SAP2000 and very good comparaisopn are observed.

Keywords: Plate Structures; energy deformation; element stresses; vibration modes; plate finite element; assembling methods.



Graphical abstract

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Modelisation and simulation of fluid's physico-thermodynamic of properties and fluid's distribution networks: genetic algorithm and artificial neural networks methods

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Abstract: The transport and/or distribution of fluid (liquid or gas) have acquired a special importance in recent decades. For distribution network managers, improving the performance of a network has always been a major worry. The first objective of this work is to develop a methodology that can create mesh networks and minimum length, for the sake of both saving on the total cost, and reliability of the network. Heuristic method is proposed that is designed in a clear, simple way and meets the requirements imposed by the constraints of the problem. This method is implemented in an easy-to-use computer program whose results appear as tables of values and graphs. The solution obtained by the program is visualized in graphical form with a possibility of action on the network obtained, and from there modifications are possible in order to improve the results. The second objective of this work aims to develop mathematical models based on the molecular structures of compounds, in order to predict some physicochemical parameters of pure hydrocarbons, through a Multi Layer Perceptron-Artificial Neural Network (MLP-ANN) based on the concept of Quantitative Structure-Property Relationships (QSPR). The resulting models from the combination between the QSPR concept and the ANN called in this thesis; Quantitative Structure Property Relationship -Artificial Neural Network (QSPR-ANN) models. QSPR-ANN models are developed to predict physicochemical parameters.

Keywords: Distribution network, QSPR-ANN, Descriptors.

Graphical abstract

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A High Environmental Sustainability Agricultural Model for Greenhouse Tomatoes Production

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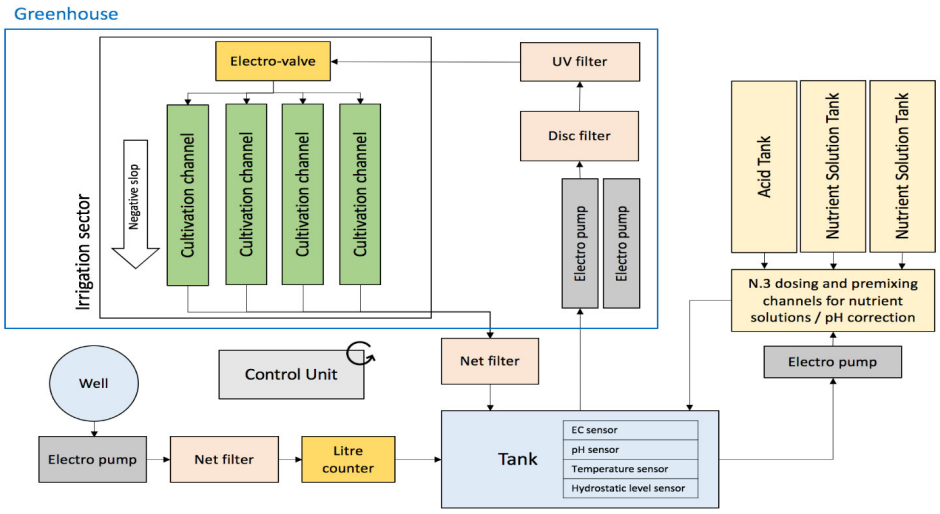
Abstract: The INTESA project – Innovation dans les Technologies à support d'un développement Soutenable de l'Agro-Industrie - co-funded by the ERDF under the ENI Italy-Tunisia cross-border cooperation program 2014-2020, foresees the development, implementation, and validation of an innovative closed-loop soilless cultivation system, called Agriponic. This system, that combines aeroponic and nutrient film technique (NFT), was developed inside a pilot greenhouse for tomato cherry plants productions. The aim of the project is to evaluate quantitative and qualitative tomato production and evaluate the sustainability of the model throughout the Life Cycle Assessment.

Keywords: Aeroponic, Closed-loop, Agriculture.



Graphical abstract

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Study and modeling of an agricultural greenhouse

Samar Harbaoui[1], Hasna Abid[1], Hamza Chiboub[1], Zied Driss[*,1], Abederrahmane Aissa[2], Costansa Aricò[3], Tullio Tucciarelli[3], Ahmed Ketata[1], Ridha Boudhiaf[1], Mohamed Salah Abid[1]

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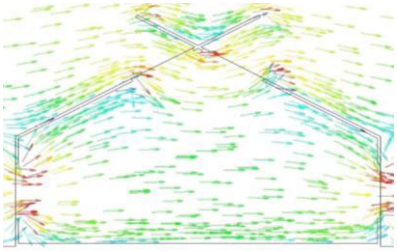
Abstract: In this paper, we are interested on the numerical modeling of a prototype of an agricultural greenhouse. The choice of the numerical model is focused on the examination of the different types of mesh with and without inflation while controlling the error and the computation time. For the study of the effect of the turbulence model on the numerical results found, we have considered different turbulence models of type of the standard k-ω, the SST k-ω, the standard k-ε, the RNG k-ε and the Realisable k-ε. To have the most adequate model, we have choosen the model which presents a low error with a minimum computation time. This choice is based on the comparison of our numerical results with the experimental measurements taken using a prototype of the greenhouse developed and installed in the test section of the aerodynamic wind tunnel available in our Laboratory of electromechanical systems (LASEM). Following our numerical simulations, we have adopted the SST k-ω type turbulence model with a mesh containing 413549 elements. This model allows the development of results with a low error and an acceptable calculation time. Thus, it is considered to investigate different geometric parameters and new aerothermal conditions.

Keywords: Agricultural greenhouse; Modeling; Aerodynamic; Experimental validation.



Graphical abstract

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Forced convection of the Al_2O_3-Water Nanofluid along a cylindrical horizontal pipe with a protuberance

Aicha Oueld M'barek[1], Abderrahmane Horimek[1,*], and Malika Gharbi[1]

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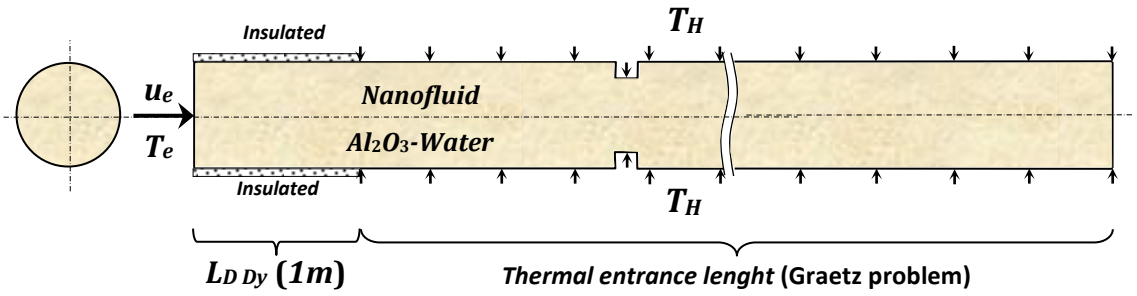
Abstract: In the present work of numerical simulation, the forced convection inside a horizontal cylindrical pipe for Nanofluid Al_2O_3-Water is studied. An insulated primary pipe is used to ensure dynamic establishment at the inlet of the pipe under imposed temperature (Graetz problem). This pipe initially simple contains a protuberance of rectangular shape. First, we determined the dynamic and thermal lengths where we recorded the reducing effect of the second with the addition of nanoparticles to the base fluid (Water), inversely to the first length where it is negligible. The placement of the protuberance clearly influences the dynamic and thermal fields. This influence depends on the geometric shape of the protuberance (height and width) and its position. The heat exchange rate directly linked to the dynamic and thermal fields is strongly altered near and on the protuberance, where degradation just before is recorded followed by a strong amplification. To better analyze the effect of the protuberance, the average Nusselt is calculated in all the assumed situations.

Keywords: Forced convection; Nanofluid; Protuberance; Nusselt number.



Graphical abstract

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Investigation of phase change material effect used in battery thermal management of electric vehicles for summer conditions

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Abstract: An electric vehicle (EV) company uses the same battery thermal management system (BTMS) in all its vehicles, regardless of geography and climate conditions. However, making specific designs considering the geographical location and climatic conditions of the city where the consumer is located can increase the battery life and range time. In this study, it is aimed to prevent catastrophic damage caused by overheating of batteries, which has been mentioned numerous times in the literature. In this experimental study, phase change material (PCM) was integrated into the radiator, which is a passive liquid cooling system element, and air was used as the heat transfer fluid (HTF). The thermal responses of the PCM in the radiator to different climatic conditions were investigated. Experiment boundary and acceptance conditions were selected according to the Mediterranean climate summer season. Experiments were made for 3 different scenarios. The scenarios are based on passing the heat transfer fluid (HTF) over the PCM at the same ambient temperature and at three different temperatures. PCM inlet temperatures were monitored for 35ºC, 38ºC and 40ºC, while ambient temperatures were 32ºC. Experiment results showed that while PCM inlet temperature was 40ºC, 11.55% decrease in PCM outlet temperature was observed. In this case, it has been evaluated that a positive development can be achieved for the summer season in PCM integrated passive liquid cooling systems.

Keywords: Passive liquid cooling system; battery management system; radiator, electric vehicles

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Modelling and simulation of multiple crack growth

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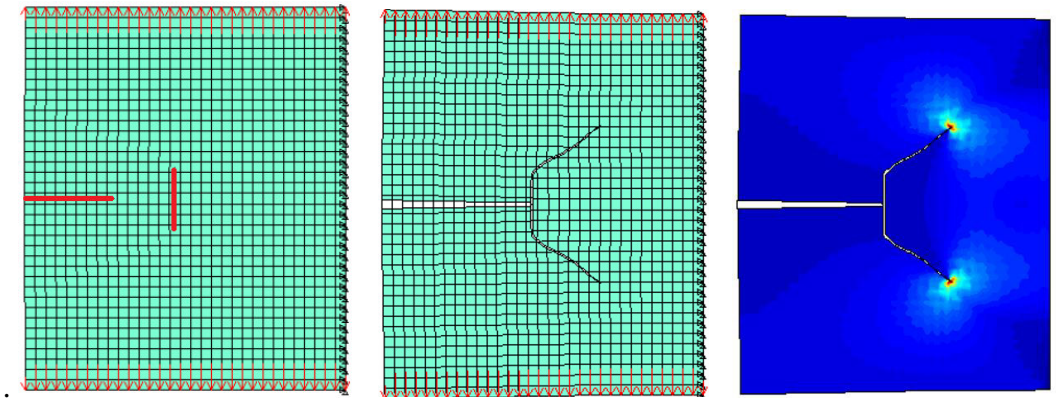
Abstract: The insufficiencies of the classical finite elements in cracked domain which requires the refining of the mesh around the bottom of crack, and also remeshing after propagation of the crack this influences the rate of convergence. In order to overcome these drawbacks, we have developed a numerical simulation code based on the extended finite element method combined with the Level Sets technique to deal with the problems of the multi-cracks growth whose numerical solutions are obtained at the using the Newton-Raphson formulation.

Keywords: finite elements method; extended finite element method; Level Sets technique; multiple crack growth.



Graphical abstract

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Is climate change in favour of solar energy potential?

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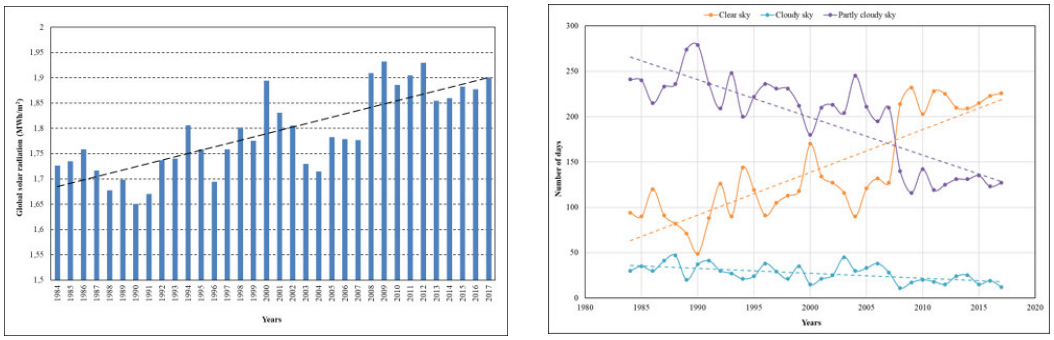
Abstract: People all across the world are feeling the effects of climate change as a result of the overuse of traditional energy sources. As a consequence of greenhouse gas emissions, mainly CO_2 generated by the combustion of fossil fuels, the earth is warming. The study of climate, or how weather patterns change over long periods, is known as climatology. The three main factors used to describe climate change are precipitation, temperature, and global solar irradiation. This study looks at the air temperature and precipitation patterns in M'Sila (an Algerian province) from 1950 to 2003. In addition to the solar irradiation for 34 years from 1984 to 2017. M'Sila is a province (wilaya) in northern Algeria. It is situated at 35°40'N and 04°30'E. It rises 441 m above sea level on average. It was observed that this region's overall warming trend was notably increased throughout the year (autumn, winter, spring, and summer). M'Sila's annual rainfall decreased. Due to a lack of precipitation in recent years, autumn has lost some of its characteristics as an agricultural season. The summer season, which is typically characterized by a dearth of rainfall, has recently seen a minor rise. M'Sila's spring and winter are marked by a lack of precipitation. M'Sila, which was previously considered semi-arid, is now considered to be in the arid zone as a result of global warming. Since 2008, M'Sila has experienced a marked increase in global horizontal and direct normal irradiation, a decrease in diffuse irradiation, and an increase in clear sky days.

Keywords: Climate change, precipitation, temperature, solar and irradiation.



Graphical abstract

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LLC Resonant Dc-Dc Converter for Battery Electric Vehicle Application

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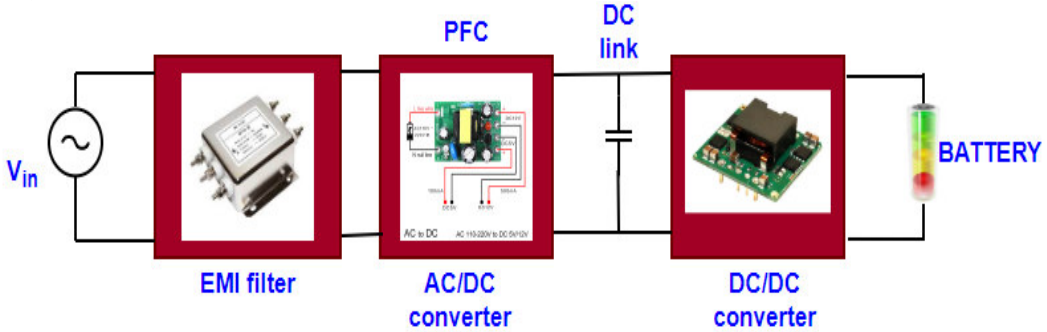
Abstract: The purpose of this research is to increase the life of the battery by employing an LLC resonant tank. The LLC tank research design, as well as the practical design assessment, are discussed in the LLC multi resonant converter. By reducing minimum and maximum frequency current ripples, the LLC-multi resonant dc-dc converter extends the life of the battery. Furthermore, bridgeless Cuk converters are used to improve the power factor. The performance of the Cuk converter in discontinuous conduction mode (DCM) has been optimized to produce a higher power factor and lower conduction losses. The modeling for the battery charging application generates a dc voltage output of 42-24 V for 650 W.

Keywords: LLC Resonant Converter; Electric Vehicle; Cuk Converter; DC-DC Converter.



Graphical abstract

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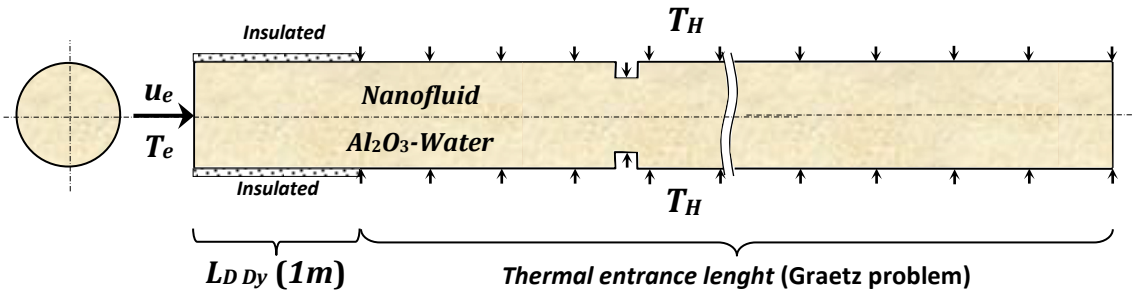
Forced convection of the Al_2O_3-Water Nanofluid along a cylindrical horizontal pipe with a protuberance

Aicha Oueld M'barek[1], Abderrahmane Horimek[1,*], and Malika Gharbi[1]

[1] *Mechanical Engineering Department, Ziane Achour University, Algeria*

Abstract: In the present work of numerical simulation, the forced convection inside a horizontal cylindrical pipe for Nanofluid Al_2O_3-Water is studied. An insulated primary pipe is used to ensure dynamic establishment at the inlet of the pipe under imposed temperature (Graetz problem). This pipe initially simple contains a protuberance of rectangular shape. First, we determined the dynamic and thermal lengths where we recorded the reducing effect of the second with the addition of nanoparticles to the base fluid (Water), inversely to the first length where it is negligible. The placement of the protuberance clearly influences the dynamic and thermal fields. This influence depends on the geometric shape of the protuberance (height and width) and its position. The heat exchange rate directly linked to the dynamic and thermal fields is strongly altered near and on the protuberance, where degradation just before is recorded followed by a strong amplification. To better analyze the effect of the protuberance, the average Nusselt is calculated in all the assumed situations.

Keywords: Forced convection; Nanofluid; Protuberance; Nusselt number.



Graphical abstract

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Sustainable Development in Low Carbon, Cleaner and Greener Energies and the Environment

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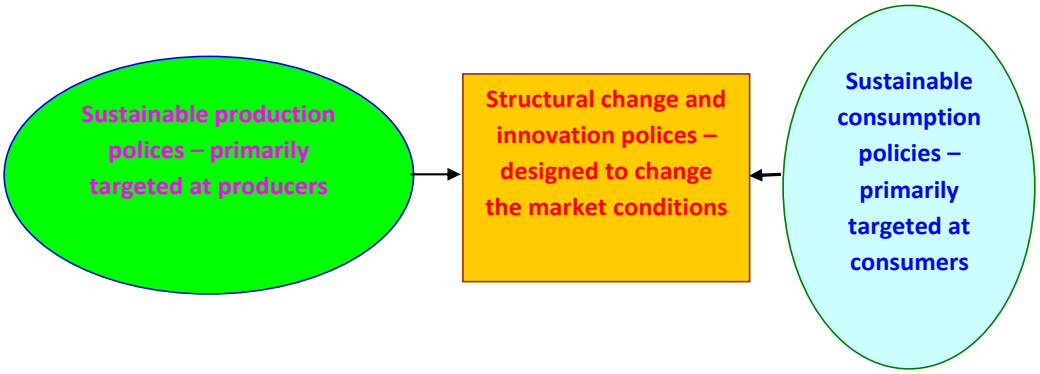
Energy Research Institute (ERI), UK

Abstract: The increased availability of reliable and efficient energy services stimulates new development alternatives. This article discusses the potential for such integrated systems in the stationary and portable power market in response to the critical need for a cleaner energy technology. Throughout the theme several issues relating to renewable energies, environment, and sustainable development are examined from both current and future perspectives. It is concluded that green energies like wind, solar, groundsource heat pumps, and biomass must be promoted, implemented, and demonstrated from the economic and/or environmental point view. Biogas from biomass appears to have potential as an alternative energy source, which is potentially rich in biomass resources. This is an overview of some salient points and perspectives of biogas technology. The current literature is reviewed regarding the ecological, social, cultural and economic impacts of biogas technology. This article gives an overview of present and future use of biomass as an industrial feedstock for production of fuels, chemicals and other materials. However, to be truly competitive in an open market situation, higher value products are required. Results suggest that biogas technology must be encouraged, promoted, invested, implemented, and demonstrated, but especially in remote rural areas.

Keywords: Renewable energy; built environmen; greener; cleaner resources; technologies; mitigation; measurements; sustainable development; environment.



Graphical abstract

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To Secure the Health Disease Data by using MCS-BR22-01 Method

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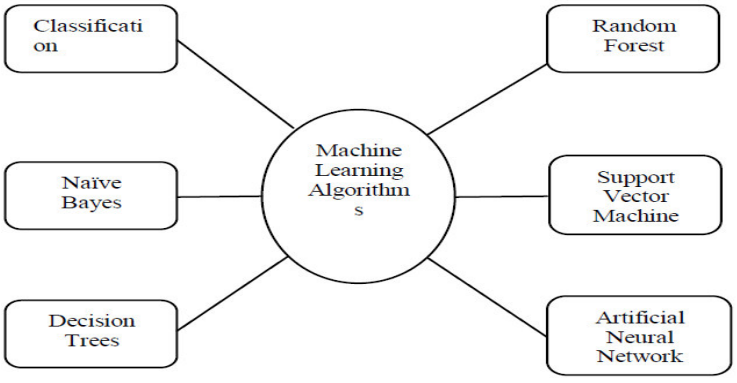
Abstract: The right world age information is most significant in people's lives, since information just concluded people wellbeing impacted in different wellbeing, illness or not, and all medical problems information. To dissect and foresee the human medical problem information by utilizing Machine Learning Algorithm. This expectation issues information that has significantly more private information and that information that needs greater security. Thus, applying the past strategy is a ChaCha technique. This strategy zeroing in on execution, just not significantly more security. The new method is MCS-BR22-01. This method has four stages. The 1st stage is finding the prime number of secret keys. The 2nd stage is prime numbers are converted into the matrix structure. The 3rd stage is N- column prime number is mixed into N- column in out data. The 4th stage is applying the "Salsa Operations". The new method provides good security as well as performance while compared to the ChaCha method.

Keywords: MCS-BR22-01, ChaCha, Column, Mix, Salsa.



Graphical abstract

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Composite solution for Hydrogen storage and transport

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[2]*Department of Physics, college of science, Qassim University, Buraydah, Almolaydah, 51452, Saudi Arabia*

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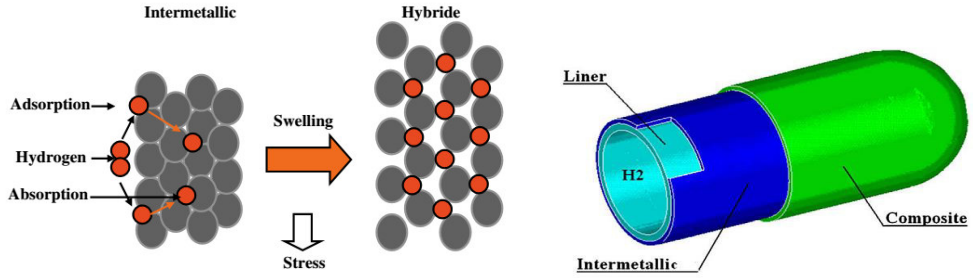
Abstract: The present paper on the way of storage and transmission of hydrogen, where it can be produced and stored in different forms, including compressed gas, liquid hydrogen (LH2), slush, solid or metallic hydrogen. This way is presented by the high-pressure hydrogen storage vessel, combining a steel liner and a wrapped composite reinforcement. Nowadays, this means has been increasingly used to the hydrogen storage and transmission. The design of a composite vessel and piping involves various integrated parameters such as the progressive failure properties, the burst pressure and fatigue lifetime. This review paper focus on development of numerical simulation and optimization for the designed composite vessel and piping based on experimental tests.

Keywords: Hydrogen; Storage; Transmission; Composite; Vessels; Pipelines; Design.



Graphical abstract

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Numerical investigation of the influence of Rounded Corners on the top of electronic components on the cooling performance

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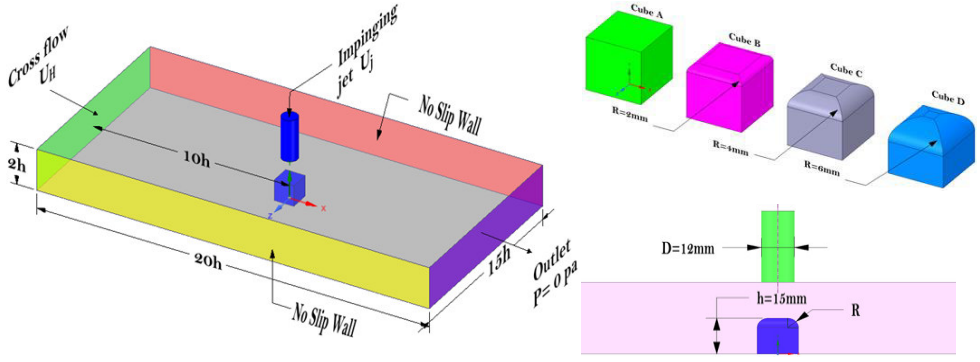
Abstract: The importance of this research is to explore and discuss the effects of the top corners rounding electronic components, which are subjected to a cross-flow and a perpendicular impinging jet on the cooling efficiency. Three different impinging ratios to a cross flow Reynolds number were investigated. The principal aim of this study is to find out the effects of the rounded corner on coherent structures and cooling improvement. The Shear Stress Transport (SST) K-ω model is implemented. Moreover, the assessment of this simulation is investigated by comparison with the experimental data of Massip et al. It should be emphasized that the high mesh resolution was handled where the wall-normal coordinate value is suitable (herein $0.01 \le y^+ \le 0.19$ for the cube wall). It is very clear that the obtained numerical results are in good agreement with the experimental data. In addition, it is found that the rounding top corners of the cube can improve the cooling efficiency for $\alpha = 1$ *and* 1.5 by more than 6% and 23% respectively when compared to a regular cube.

Keywords: CFD; wall-mounted cube; Nusselt number; cooling electronic components.



Graphical abstract

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Abstracts

Innovation and industrial applications

Design and construction of a solar dryer using an aerovoltaic system for drying food products

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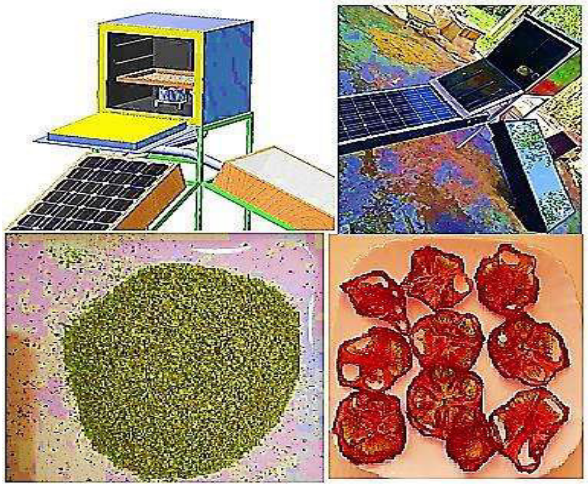
Abstract: In this paper, we are interested in the design and manufacture of an aerovoltaic system for drying food products and medical plants. In these experiments, we used an indirect solar dryer, where in the latter we believe the heat from the drying chamber by a hybrid photovoltaic (thermoelectric) panel reaches the temperature it comes out of the hybrid collector of 60.8 - 69.9 degrees Celsius combined with a greenhouse effect. The main objective of these experiments is to use free energy (the sun) to study drying kinetics and water content. The results obtained in this study were as follows: to dry 150 grams of Mint, the desired temperature range is 41.1 - 49.9 °C for 3 hours and for 710 grams of Tomato 58.4 - 68.8 °C under 4 hour circumstances. The purpose of the drying process of these products is that the wide use of these products dried, while preserving the nutritional value of the product and good quality.

Keywords: Flat plate collector, solar energy, PV solar panel, PV/T solar panel, convective drying kinetics, global sunshine, drying of agri-food products.



Graphical abstract

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A numerical investigation of a melting rate enhancement inside a thermal energy storage system with nano-enhanced PCM

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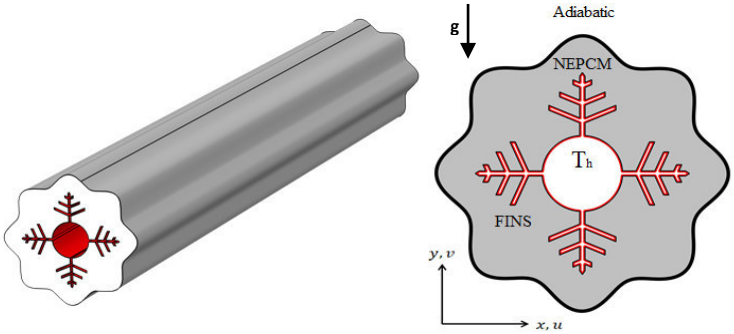
LPQ3M, University of Mascara, Algeria

Abstract: Thermal energy storage via the use of latent heat and phase transition materials is a popular technology in energy storage systems. It is vital to research different thermal enhancement techniques to further improve phase transition materials' weak thermal conductivity in these systems. This work addresses the creation of a basic shell and tube thermal storage device with wavy outer walls. Then, two key methods for thermal augmentation are discussed: fins and the use of a nano-enhanced phase change material (NePCM). A numerical model is developed to highlight the viability of designing such a store utilizing reduced assumptions, both for engineering considerations and real-time predictive control methods. Different concentrations of copper nanoparticles (0, 2, and 4 vol %) and wavenumbers (4, 6 and 8) are investigated in order to get the best heat transmission and acceleration of the melting process. The time required to reach total melting in the studied TES system is reduced by 14% and 31% in the examined TES system, respectively when NePCM (4 vol% nanoparticles) and N=8 are used instead of pure PCM and N=4. The findings revealed that the melting rates accelerated at the upper portion of the examined annulus due to the presence of free convection.

Keywords: Shell-and-tube TES; nano-enhanced PCM; nanoparticles; fins; latent heat energy storage.



Graphical abstract

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Innovation and industrial applications

Evaluation of Mechanical Properties and Fatigue Performance Under High Temperatures Application Using AA2024-T361

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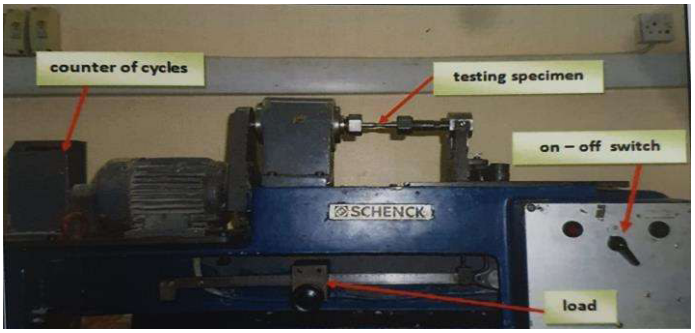
[2] *Bilad Alrafidain University College, Iraq*

Abstract: AA2024-T361(The equivalent for AA2024-T_4) has become an essential materials in many modern applications. A wide application such as automobile & marines , aviation industries etc., because of its non-corrosive property and light in weight. This paper presents experimental study, in which the mechanical and fatigue properties have been reduced by using the interaction of high temperature with tensile and fatigue tests. When applying 200 ^{O}C and 250 ^{O}C temperatures the reduction percentage in mechanical properties were comparison between the present work with the past literature was made and it was observed that the results are in well agreement.The results may lead to development of tools that reduced the service life on various metals 13.4% ,26.94%, 9.09%, 13.3% and 22%, 46.11%,14.28% ,23.22% at 200 ^{O}C and 250 ^{O}C respectively. The fatigue behavior of Aluminum alloy 2024-T361 is investigated under elevated temperatures and it is observed that the fatigue strength of 2024-T361 Aluminum alloy is reduced by a lowering factor of (0.164) within the limits of the past results for aluminum alloys.Rotation bending constant fatigue experiments revealed that with high temperatures 200 ^{O}C and 250 ^{O}C significantly reduced the mechanical,fatigue life and strength.

Keywords:AA2024-T361;mechanical properties;fatigue behavior;different temperatures.



Graphical abstract

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The BR22-02 Algorithm Used to Secure General Health Data

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Abstract: The right world generation data is most valuable in humans life, because data only decided humans health affected in various health disease or not, and all health issues data. To analyze and predict the human health issue data by using Machine Learning Algorithm. This prediction issues data has much more confidential data and that data need more security. So, applying the previous method is ChaCha method. This method focusing on performance only not much more security. The new method is BR22-02. This method has eight stages. The 1st stage is finding the secret key x & y value. The 2nd stage is applying key in Equation (1).The 3rd stage is merge all values into single row then pair from left and swap the values in the HS matrix. The 4th stage is applying key in Equation (2). The 5th stage is merge all values into single line then pair from left and swap the values in the HC matrix but reverse. The sixth stage is find the "perfect number". The seventh stage is pair it from left. The eight stage is swap the cells by using previous stage. The new method has provide good security as well as performance while compared to ChaCha method.

Keywords: BR22-02; ChaCha; Health; Human; HS; HC; Key; Perfect.

Graphical abstract

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Optimizing HVOF process parameters to prepare cermet coatings for tribological applications

Fida Harabi [1], Basma Ben Dhifallah [1], Mohamed Kharrat [1], Clizia Aversa [2], Massimiliano Barletta [2], Stefano Lionetti [3], Roberta Valle [3]

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[2]*Department of mechanical engineering, University of Roma Tre, Roma, Italy*

[3]*Materials Development Center, Rina Company, Roma, Italy*

Abstract: High velocity oxygen fuel (HVOF) is classified as a thermal spraying technique used to produce cermet coatings with low porosity and good coating/substrate adhesion properties. In this investigation, preliminary works focuses on the effect of process parameters of a gas-drive HVOF system on the structure, morphological and wear of NiCrSiFeB matrix. The main differences in spray conditions in terms of configuration of the nozzle and the distance projection are evaluated. Tribological behavior of C45 steel substrate was also characterized by using alternated tribometer. It was determined that a severe abrasive wear mode was recorded.

Keywords: Thermal spraying coating; HVOF; spray parameters; optimization; C45 steel; substrate; NiCrFeSiAlBC matrix; tribological behavior.

Graphical abstract

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Extraction, characterization and upgrading of natural unconventional oils

Sihem Jmem*, Ahmed Aloulou, Aida Karray

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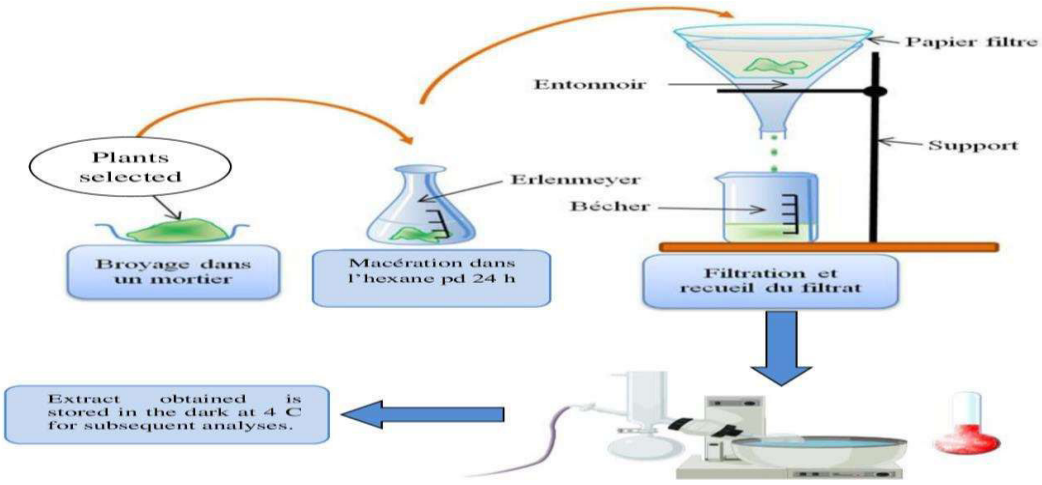
Abstract

In this work, we propose the idea to make an innovation in the production of oils from unconventional natural sources. These unconventional oils can be used in the food sector, pharmaceutical or energy fields.These objectives of working, first, is to extract unconventional oils, then to characterize them physico-chemical, in addition, to follow the digestibility in vitro by lipolytic enzymes and finally, to make a biotechnological valorization.

Keywords: Unconventional oils; digestibility; biotechnological valorization.



Graphical abstract

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Estimates of the degree of harmfulness of a crack: case of plates

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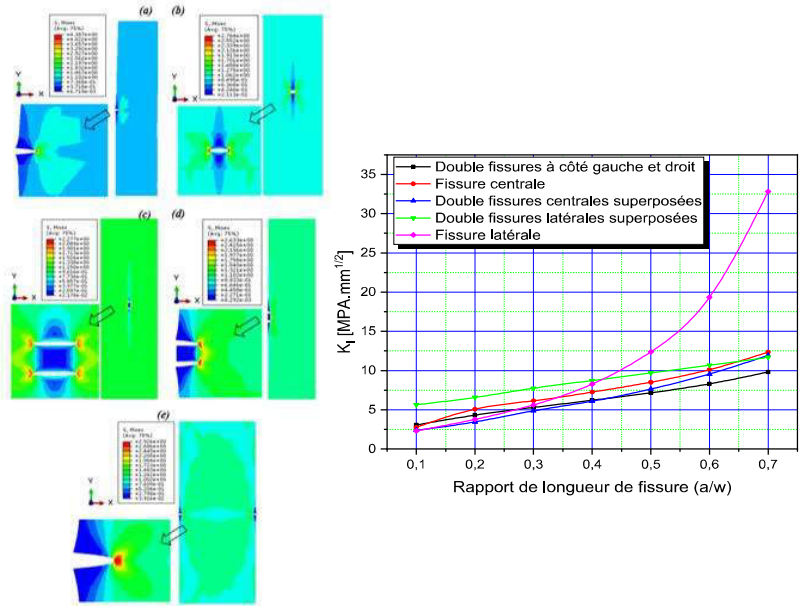
Abstract: The objective of this work is to determine the evolution of the degree of harmfulness of a defect in a cracked plate under static loading on the one hand, and to work out an analytical expression which gives the values of stress intensity factor of the another hand. For this, a 2-D numerical modeling in pure I mode was carried out of the specimens with different configurations using the Abaqus14 computer code based on the finite element method. Based on the numerical results obtained from the different models treated, an empirical expression has been proposed according to the geometric parameters of the cracked specimens such as the length of the crack and the width of the specimens.

Keywords: Degree of harmfulness; static loading; stress intensity factor; finite element method; empirical expression; geometric parameters.



Graphical abstract

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Effect of chemical treatments on the mechanical behavior of date palm leaflet fibers biocomposite materials

Abdelkader Boudjemline [1], Belhi Guerira [2], Hamida Boussehel [3], Paulo Reis [4], Zied Driss [5], Noureddine Belghar [6]

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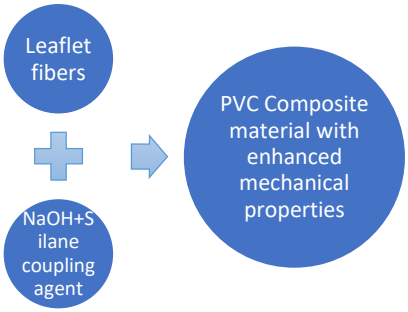
Abstract: In the context of natural waste valorization, the world is undergoing a subversive shift toward biosourced materials. This research aims to evaluate the effect of various chemical treatments on the mechanical and physical behavior of date palm fibers (DPFs) and reinforced DPFs composites. Leaflets were subjected to NaOH and silane coupling agent (SCA) treatments ensuing by IR spectrometry analysis. PVC composites reinforced with treated and untreated fibers were subjected to tensile and 3-point bending tests to evaluate Young's and bending modulus. Unlike untreated fibers, results show that leaflet powder subjected to SCA and NaOH treatments has the best mechanical properties. Composite materials with such mechanical properties could enhance the development of several industrial applications.

Keywords: Natural wastes; date palm fibers; leaflets; Silane coupling agent.



Graphical abstract

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Study weldability of Gas Turbine Blade by layer of ERNiCrMo-3 with Layer of ER316 as Filler Alloys

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Abstract : This paper aims to study the microstructure of the welded gas turbine blade of type Mar-M247 superalloy using the layer of ERNiCrMo-3 with a layer of ER 316 (stainless steel) as filler alloys to achieve the weld. The welding process was implemented by Gas Tungsten Arc Welding (GTAW). The produced solidification mode of the mixed filler alloys in the melting zone is a fully austenitic structure. The results of the microstructure appear to the presence unmixed zone nearby the fusion boundary which is different from the welding metal. The epitaxial structure has not been achieved between the elements of the mixed filler alloys due to the full segregation as a result of the difference in chemical composition and crystal structure of these alloys. The tests of the welded specimen were carried out by optical microscope, Scanning Electronic Microscope (SEM), and line/point analysis using the EDS technique. Solidification cracks occur immediately after the solidification process in the fusion zone as a result of the internal stresses which are higher than the weld metal strength.

Keywords: Weldability; Superalloy; Filler alloys; HAZ; GTAW.

Graphical abstract

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Impact of Heterogeneous Cavities on the Electrical Constraints in the Insulation of High-Voltage Cables

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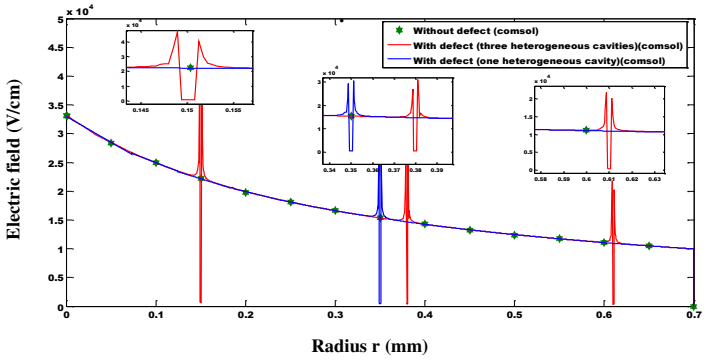
Abstract: Knowledge of the presence of heterogeneous cavities in the insulating material is a major problem when the insulating material is used as cable insulation due to the occurrence of partial discharge (PD). Therefore, this study investigates the effect of the presence of such heterogeneous cavities in high-voltage cable insulation. Furthermore, the effect of changing the cavity location and size on the PD behavior under different operating conditions was investigated using the COMSOL program. The simulation results are in good agreement with the mathematical model in our study. The obtained results are in good agreement.

Keywords: Heterogeneous cavities; Electric field and potential; Cables.



Graphical abstract

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Simulation of a Cap and Pin Insulators Using Improved Simulation Technique

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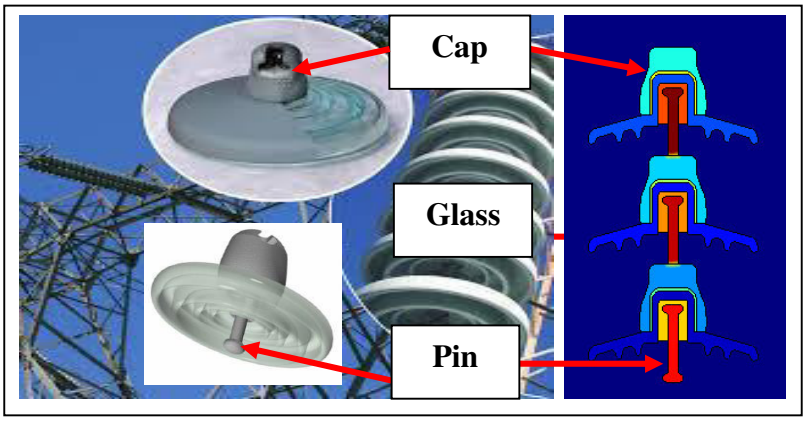
Abstract: Cap and pin insulators are at risk for surface arcing phenomenon, especially in highly polluted or coastal areas. Therefore, it is very important to determine the electric field and electric potential distribution at industrial frequency. This paper presents a two-dimensional (2D) numerical model based on the finite element method to see the distribution of the potential and the electric field along the leakage distance of our studied model. The obtained simulation results found from the COMSOL Multiphysics 3.5 confirm the effectiveness of the proposed method, and good results are achieved.

Keywords: Insulators; Mesh, Electric field; Electrical potential; Comsol.



Graphical abstract

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Numerical Simulation of the Barrier Effect on the Breakdown Voltage in Point-Plane Air Gaps Using Minitab

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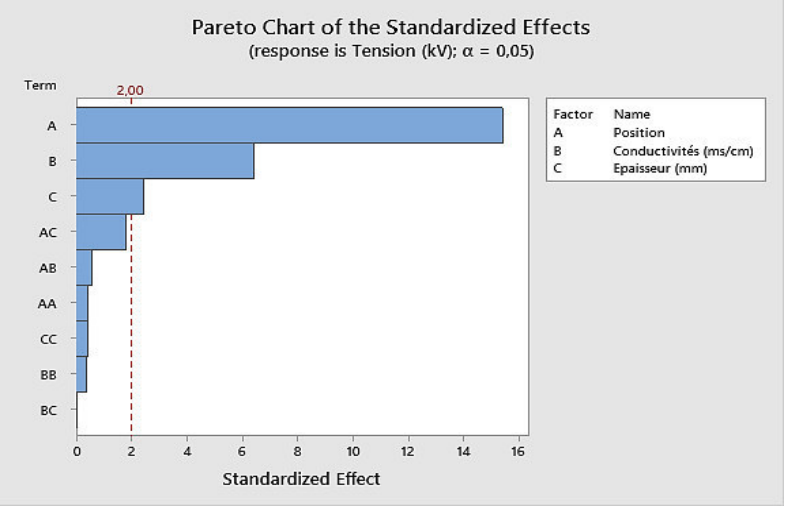
Abstract: Nowadays, a number of research papers have been carried out in the field of discharge and breakdown phenomena, particularly in the geometry of point plane. The prediction of the breakdown voltage of a point-barrier-plane configuration polluted by Minitab is offered in this work by a numerical model based on the experimental design method (DOE). To confirm the effectiveness of the proposed method, the results obtained is also verified with measurement values available in the literature, and a good correlation is achieved.

Keywords: DOE; point-barrier-plane; pollution; breakdown voltage; Minitab.



Graphical abstract

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A study of Shunt Active Filter for Harmonic Compensation in a Four-Wire Distribution Network Under Unbalanced a Load Conditions

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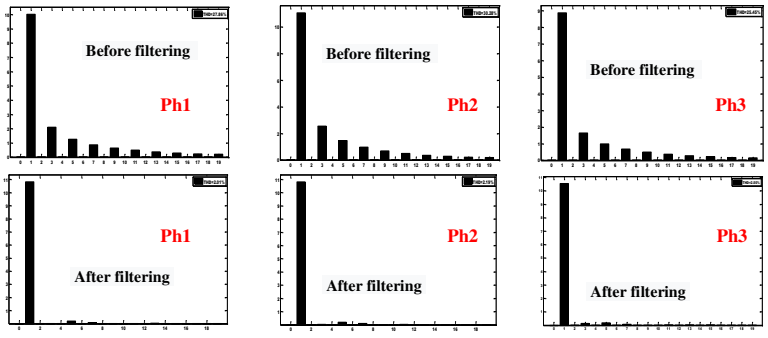
Abstract: Simulation of Three-Phase Four-Wire Shunt Active Power Filter (SAPF) reduced current measurement control method generated by nonlinear loads is investigated for operation of four-wire shunt active power filter (SAPF) under unbalanced load conditions is proposed in this work. Results obtained by simulations with Matlab /Simulink show that the proposed approach is an effective approach for compensating reactive power and harmonic currents of the load.

Keywords: Active Power Filter; Three-phase four wire systems; Harmonic Compensation.



Graphical abstract

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Mechanical design and Denavit-Hartenberg kinematic analysis of a quadruped robot

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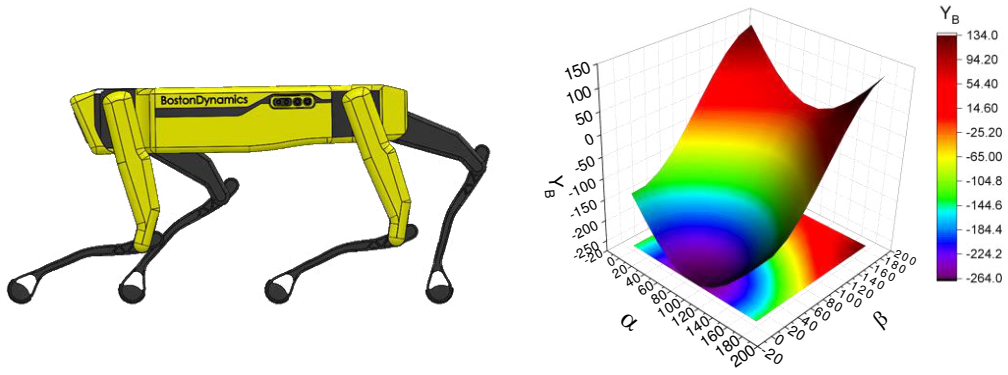
Abstract: This paper contributes to the other studies about kinematic analysis on quadruped robots. On this basis, the present work focuses on one leg among the four legs of the robot. Firstly, computational aided design (CAD) models of the quadruped robot and their legs have been designed using the Solidworks software. Based on the suggested design, a kinematic schema of one leg of the quadruped robot has been built. This kinematic schema is consisting of four solid branches which are linked with four rotation joints. Secondly, a forward kinematic analysis has been contacted to determine the motion law of the leg. The developed motion law allowed the recognition of the leg's endpoint given the geometrical parameters associated with the rotation joints. Thirdly, an inverse kinematics analysis using the Denavit-Hartenberg method has been developed using the MATLAB software. This method allowed to calculate the legs joints angles knowing the mass center position and the location of the leg's endpoints of the quadruped robot. The different position configurations of the quadruped robot have been plotted and discussed. The results proved the validity of the suggested moved in the kinematic point of view.

Keywords: Quadruped robot; Legs; CAD; Denavit-Hartenberg method; Inverse and direct kinematic analyses.



Graphical abstract

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Experimental study on the thermal properties of bio-composite reinforced with palm fibers

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Abstract: Natural fibers have been used for many centuries for different purposes since the beginning of civilization. Natural fibers are of two types. Natural inorganic fibers such as basalt, asbestos, and others are natural organic fibers such as coconut, palm, kenaf, jute, sisal, banana, pine, sugar cane, bamboo, this work presents an experimental study of the thermal properties of a bio-composite composed of plaster and date palm fibers (DPF). The thermal properties of the bio composite were determined in terms of thermal conductivity and density. The palm fibers are incorporated, without any prior treatment, into a plaster mixture. Five samples containing different percentages of palm fibers are prepared and examined. In addition, the palm fiber interface is observed by scanning electron microscopy (SEM). The experimental results show that the reinforcement of the plaster with palm fibers decreases the thermal conductivity.

Keywords: Natural fibers, Bio-composite, Date Palm-tree-fiber, Thermal Conductivity, Density, Scanning electron microscopy (SEM), Thermal properties, plaster.

Graphical abstract

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Influence of treated date palm fibers on the behavior of biomaterials

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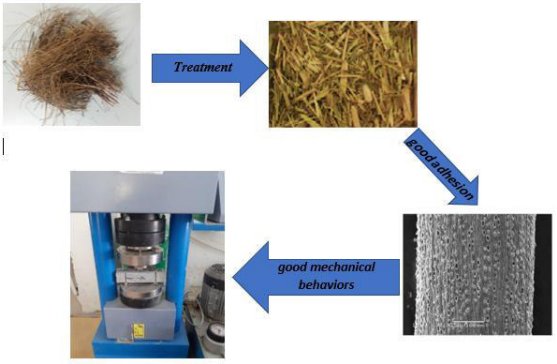
Abstract: Strict environmental regulations and an increased interest in the preservation of natural resources have forced the composites industry to turn to plant fibers. Efforts are made to find alternative reinforcements and resin systems that are environmentally friendly while still providing the same performance as their synthetic counterparts. As part of our research on the adhesive zone between date palm fibers (DPF) in biomaterials and to improve the behavior of date palm plant fiber in mortar, we have carried out a type of treatment that directly addresses fiber (alkaline treatment). Mechanical tests were carried out to determine the adhesion stress between the different matrix components, the maturity of the mortar varying from 3, 7, 14, and 28 days.

Keywords: Environmental friendly, Date palm fibers (DPF), Biomaterials, Alkaline treatment, Mechanical tests.



Graphical abstract

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Statistical analysis of the mechanical properties of bio sourced mortars

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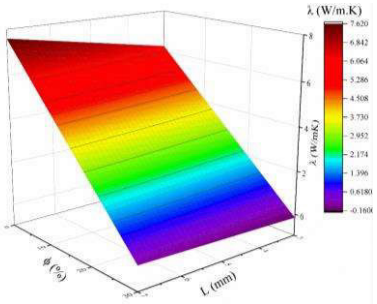
Abstract: Scientists have begun in recent decades to initiate studies on biosourced materials for reasons of respect for the environment and research into more sustainable materials. Therefore, this work presents a statistical analysis ff the use of a new bio-based material composed of natural fibers, date palm fibers (DPF), cement and sand. In addition, to study the effect of the addition of date palm fibers (DPF) on the mechanical characteristics of mortars in order to analyze with the experimental plan the properties of this new biobased material intended for use in the construction of buildings. The weight percentage of date palm fiber in the test samples ranged from 0% to 18% for a fiber size of 7 mm in length. statistical analyzes on the mechanical behavior of biobased mortars have been determined in terms of resistance to bending and compression. The results show that while increasing the weight of the DPF, an obvious decrease in the flexural and compressive strength of the composites.

Keywords: Statistical analysis, Environmental friendly, Date palm fibers (DPF), bio-sourced.



Graphical abstract

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Investigation of phase change material effect used in battery thermal management of electric vehicles for summer conditions

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Abstract: An electric vehicle (EV) company uses the same battery thermal management system (BTMS) in all its vehicles, regardless of geography and climate conditions. However, making specific designs considering the geographical location and climatic conditions of the city where the consumer is located can increase the battery life and range time. In this study, it is aimed to prevent catastrophic damage caused by overheating of batteries, which has been mentioned numerous times in the literature. In this experimental study, phase change material (PCM) was integrated into the radiator, which is a passive liquid cooling system element, and air was used as the heat transfer fluid (HTF). The thermal responses of the PCM in the radiator to different climatic conditions were investigated. Experiment boundary and acceptance conditions were selected according to the Mediterranean climate summer season. Experiments were made for 3 different scenarios. The scenarios are based on passing the heat transfer fluid (HTF) over the PCM at the same ambient temperature and at three different temperatures. PCM inlet temperatures were monitored for 35ºC, 38ºC and 40ºC, while ambient temperatures were 32ºC. Experiment results showed that while PCM inlet temperature was 40ºC, 11.55% decrease in PCM outlet temperature was observed. In this case, it has been evaluated that a positive development can be achieved for the summer season in PCM integrated passive liquid cooling systems.

Keywords: Passive liquid cooling system; battery management system; radiator, electric vehicles

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Galling failure analysis in the cold plastic rolling process

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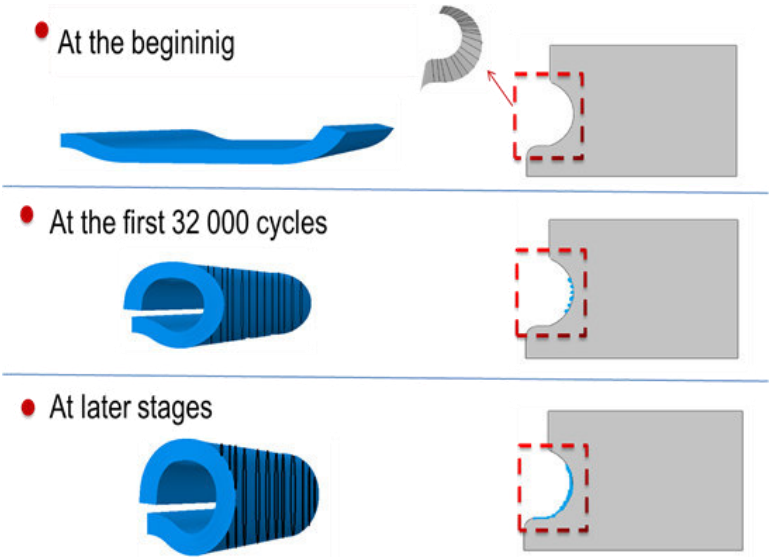
Abstract: Galling is a known failure mechanism in sheet metal forming operations, and it can lead to fracture of the products and jamming of the tool. The present work focuses on the sliding metallic contacts taking place in the case of the hinges manufacturing. A case study has been conducted on the cold plastic rolling (CPR) tool and the hinges in the CPR process. An expertise of CPR die and hinge surface was carried out in order to identify and to analyze the failure mechanisms. The failure of the CPR die was found to be related to the transfer of fragments from the hinge material and then their accumulation on the tool surface, generally referred to galling. The failure mechanisms of the hinge material have been found to depend on the number of manufacturing cycles.

Keywords: Sheet metal forming; Galling; Failure; Cold plastic rolling process.



Graphical abstract

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Claw-pole TFPM with Discoid Rotor Design

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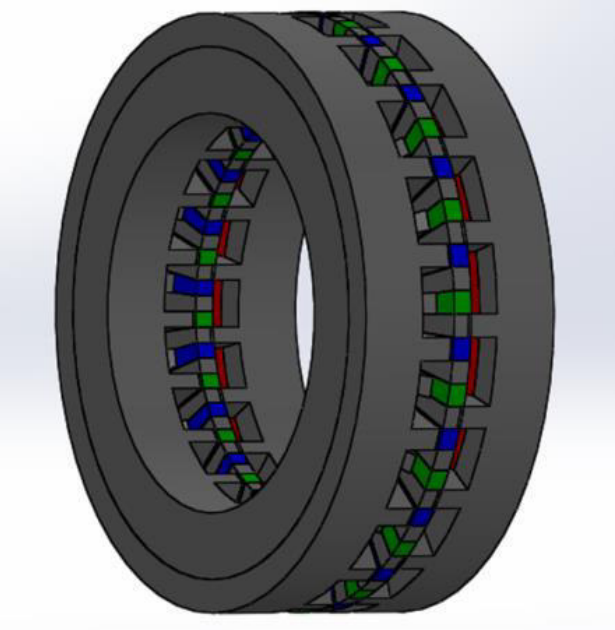
Abstract: A new configuration of claw-pole transverse flux permanent magnet synchronous machine (TFPM) with a discoid rotor and a stator which contains claw-shaped teeth allowing conduction of the flux in the axial direction into the stator. The machine offers the advantage to operate with a same rotor disc for two stator phases, unlike existing claw pole machines. The machine combines the advantages of Transverse Flux Synchronous Machines (TFPM) and the Axial Flux Synchronous Machine (AFPM). This configuration can be mounted directly in vehicle wheels. A specific sizing of the stator teethes is required for this design where the dimensions depend on the used length of the overlap between teethes.

Keywords: Claw pole TFPM; Discoid rotor; Sizing.



Graphical Abstract

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Agroindustry development

Effect of the combine equipment on some performance indicators for the michinary uints

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[2] *University of Baghdad-college of agriculture, Baghdad, Irak*

Abstract: Five multipurpose integral implement was manufacturing and assembling used for primary and secondary tillage, shallow furraw opener, seeding and fertilization in one time. It consists of primary and secondary tillage implement, smoothing, shallow furraw opener, seeding and fertilization implement. The experiment was conducted to study the performance of the combine implement and its effect on water consumption and barley green forage yields in one of the Agrictural College University of Baghdad experimental fields in loamy soil, 2017. Massy forgison tractor (MF-650) was used with the implement. Three machinary speed included 3.15, 4.60, and 6.10 km/h. Seeding implement included manufactured combine implement, seeding and fertilizer implement and manual seeding were used in this experiment. Soil balk density, soil moisture content, slippage percentage, fuel consumption were studied. Nested design under randomized completes block design with three replicates was used in this experiment least significant differences (LSD) under 0.05 level and was used to compare treatment means.

Keywords: Rarefied flow; porous media; transition regime; Direct Simulation Monte Carlo; Lattice-Boltzmann; mesoscopic methods.

Graphical abstract

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Energy efficiency

Heat Sink with Change Phase Materials and Nano-fluids For Thermal Management Applications

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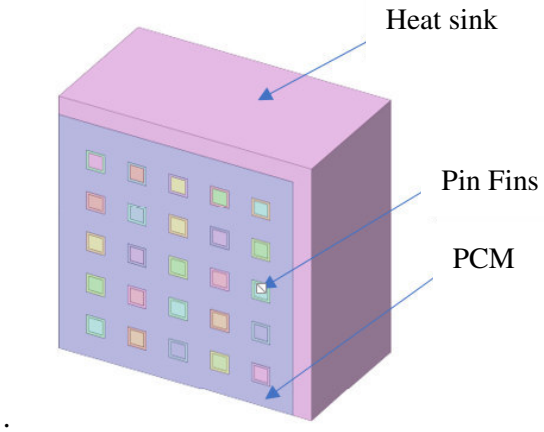
[2]Laboratory of Mechanics of Normandy (LMN), INSA Rouen Normandy, Universityof Rouen, St-Etienne de Rouvray, 76801, France

Abstract: This work presents numerical investigations of a novel design of finned heat sinks filled with nanofluids and phase change materials (PCM). The RT44 is used as PCM and the nanofluids are composed of water and graphene with a weight fraction of 5%. Additionally, the effects of the insertion of pin fins with volume fractions of 9% are studied. The results show that the insertionof the fins reduced the base temperature of the heat sink. Additionally, the dispersion of the graphene inside the water doesn't improve the heat sink performance and the effect of the nanofluids doesn't have a significant effect due to the high conductivity of the pin fins. The small amelioration of the thermal conductivity of the fluid is neglected compared to the contribution of fins in ameliorating the thermal response of the heat sink.

Keywords: Phase change materials; nanoparticles; pin fins; thermal management.



Graphical abstract

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CFD Simulation for Non-Uniform Heat Flux Distribution on Two Parabolic Trough Collector Alternatives Receiver

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Abstract: Thermal efficiency of solar concentrator is highly influenced by the solar flux distribution on the receiver tube; the more uniform the flux distribution on the receiver tube, the higher the efficiency. The influence of non-uniform heat flux distribution on two Parabolic Trough Collector "PTC" alternatives were investigated in this study; PTC with stainless steel sheet and Semi-Parabolic Linear Fresnel Reflector "SPLFR". A simulation on Ansys software was run to see how the spread of sunrays affected the receiver. SPLFR produced more uniform flux than the stainless-steel sheet, according to the results. As a result, there is a 5.8% improvement in thermal efficiency.

Keywords: Heat Flux Distribution, Uniformity, Thermal Efficiency, PTC, SPLFR.

Graphical abstract

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A numerical study of the influence of scale on the aerothermal performance of a solar chimney

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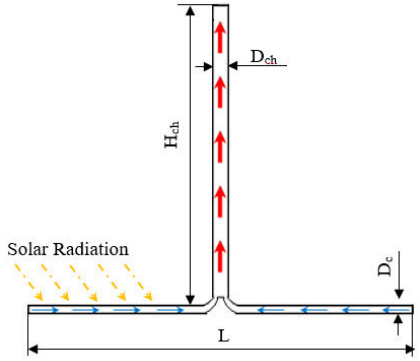
Abstract: The mechanism of the solar chimney power plant is based on a natural phenomenon. This technology would make it possible to generate electricity from the sun almost continuously, a great advantage over other technologies that use the solar. In this paper, a comparative analytical and numerical study is carried out for the geometrical optimization of a prototype solar chimney power plant. An evaluation of the solar chimney performance was simulated with configurations for different geometric scales. The numerical predictions were validated by comparing with experimental data of the Spanish prototype solar chimney and the prototype of our anterior results. The operating parameters considered are the temperature, the pressure, the velocity, the mass flow rate and geometrical parameters such as the chimney height and collector diameter. The aim of this study is to perform a more detailed numerical analysis of a solar chimney power plant by investigating the scale effect on the aero thermal parameters.

Keywords: Turbulent flow; aerodynamic structure; CFD; building; design.



Graphical abstract

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Numerical simulation of the heat ventilation in a room by using a solar air heater

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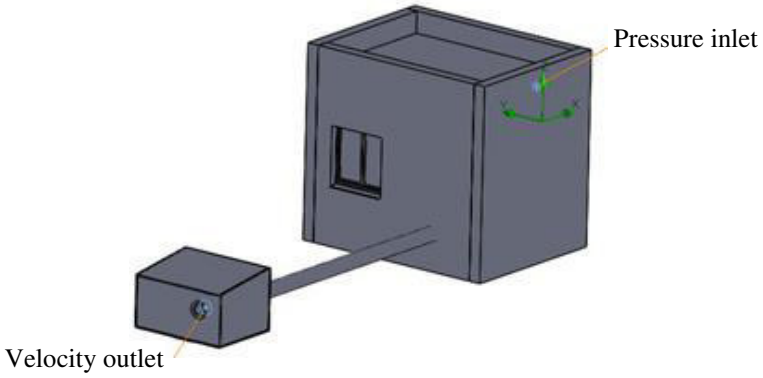
[2]*Laboratoire de Physique Quantique de la Matière et Modélisation Mathématique (LPQ3M), University of Mascara, Algeria*

Abstract: Solar air heater is a type of solar system which collects solar energy and transforms it into heat. The general idea is that the air is flowing through solar collector and heat from sun naturally raises the temperature of the air inside the collector. The advantage of this technology is that it is cheap and simple. The main objective of this work is to design and build a solar air heater test bench. For this, we have developed an experimental study, in order to compare between several modes of forced and natural convection. The hot jet was also tested inside a room. Then, we have investigated numericaly the fluid flow in the considered system. The comparison between the numerical and the experimental results presents a good agreement and validate our numerical approch.

Keywords: Turbulent flow; aerodynamic structure; CFD; building; design.



Graphical abstract

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Renewable energy

Enhancement convective heat transfer by jet impingement on a detached rib surface

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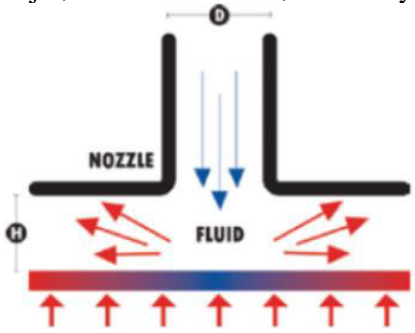
Abstract: The study of the heat transfer enhancement of a flat surface with axisymmetric detached ribs due to the impact of normal air jet. The objective of this study is to examine the effect of rib heights on the local heat transfer distribution and flow characteristics by jet impingement cooling on a rough surface. Mainly four ribs heights on the impact plate 0.36, 0.72, 0.96 and 1.2 are considered. The effect of number of jets on convective heat transfer performance was also studied numerically three values of N (1, 3 and 5) were considered in the calculations respectively. The average and local Nu number distributions, the flow characteristics and the results of the study were analysed. The results were compared with those of the smooth surface plate of the jet impact configuration. The results showed that the feasible k-ε turbulence model accurately reveals the experimental data. The predictions show that the ribs height has a great influence on the flow and heat transfer characteristics in the wall jet region. In addition, it was found that a poorly constructed rib height decreased the heat transfer efficiency. A correlation relationship that predicts the average Nusselt number as a function of both rib height and jet number is also provided. The heat transfer improvement decreases for higher Hr.

Keywords: Heat transfer; air jet; turbulence model; efficiency.



Graphical abstract

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Calculation of the different efficiencies of the parabolic cylindrical concentrator coupled to a nuclear reactor

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Abstract: Solar energy is energy transmitted by the Sun in the form of light and heat. This energy is virtually inexhaustible on the scale of human times, which is why it is classified among renewable energies. The technology of parabolic reflectors is the most common and is currently used by the most powerful solar power plants in the world. This work represents the calculation of different efficiencies of the parabolic cylindrical concentrator in a certain climatic condition and proprieties of the heat transfer fluid (soduim), in order to discover the state of service in every step of the concentrator. The use of this consontator to feed a nuclear power plant, and this because the outlet temperature of molten salts reaches 1100 Kelvin.

Keywords: Nuclear reactors; Solar energy; parabolic cylindrical; concentrator; efficiencies.

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Graphical abstract

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Numerical simulation of a new brick wall with double layer phase change material (PCM) for thermal comfort with hot and cold climatic conditions

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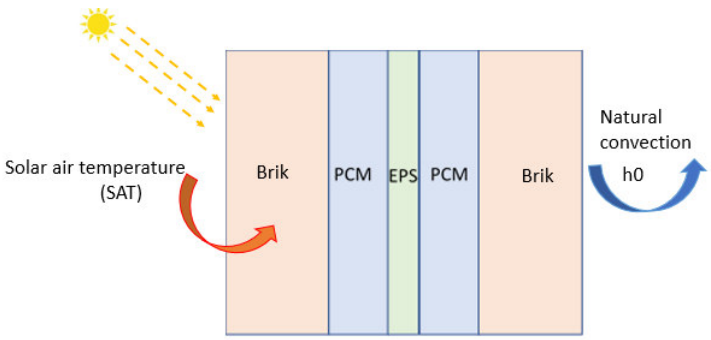
Abstract: Phase change materials (PCM) have a large number of applications for thermal energy storage (TES) and temperature reduction in buildings due to their thermal characteristics and latent heat storage capabilities. Thermal mass of typical brick walls can be significantly increased mainly by using PCM, based on phase change temperature and heat of fusion for different weather conditions in summer and winter. This study proposed a new double-layer PCM configuration for brick walls to maintain human comfort in Mediterranean climatic conditions. Numerical simulations were carried out using Ansys Fluent for double PCMs superimposed in a brick wall for average and typical temperature of June and January. This study investigated and discussed the charging and discharging cycles of PCMs over an extended period (5 days) to determine whether the effectiveness of PCMs is hindered due to difficulties in discharging. The results show that the combined use of the two mentioned PCMs provides better human comfort with reduced energy requirements.

Keywords: Building, Phase change material, PCM, thermal comfort, Ansys fluent



Graphical abstract

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Experimental Study of Solar Air Heater integrated with internal finned phase-change material thermal storage

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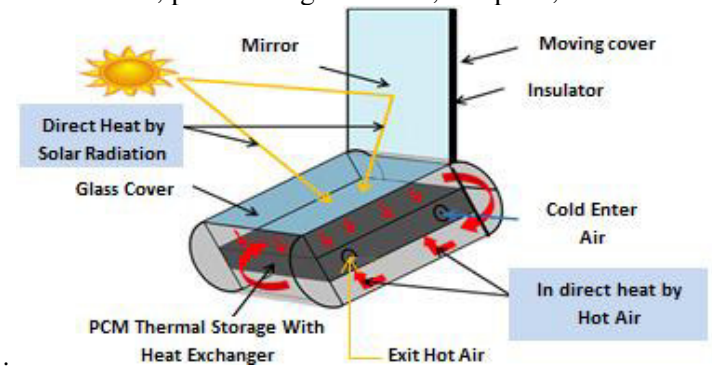
Abstract: A novel design is presented. a closed collector – storage solar air heater system integrated with internal finned heat exchanger. The heat exchanger storage unit was immersed in RT42/RT50 wax as PCMs placed bellow the absorber. The main objective of this experimental analysis is to enhance the solar air heater thermal efficiency, decrease usual thermal losses, overcame the PCM low thermal conductivity, and accelerating the melting of paraffin wax using (direct heating) by solar radiation and (indirect heating) by the hot air surrounding the thermal storage unit. Also, finned heat exchanger increased the heat transfer rate between the PCM and air during discharge period. The reached average charging efficiency of the system for RT42 and RT50 without and with mirror were 83%,87%,80%,84%, respectively. The maximum temperature difference between exit air & wax was 2.5 ℃ during the discharging period.

Keywords: Solar air heater; phase change material; flat plate; finned heat exchanger.



Graphical abstract

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Performance evaluation of the "MD ORYX" autonomous desalination solar-driven membrane distillation plant in Kairouan, Tunisia

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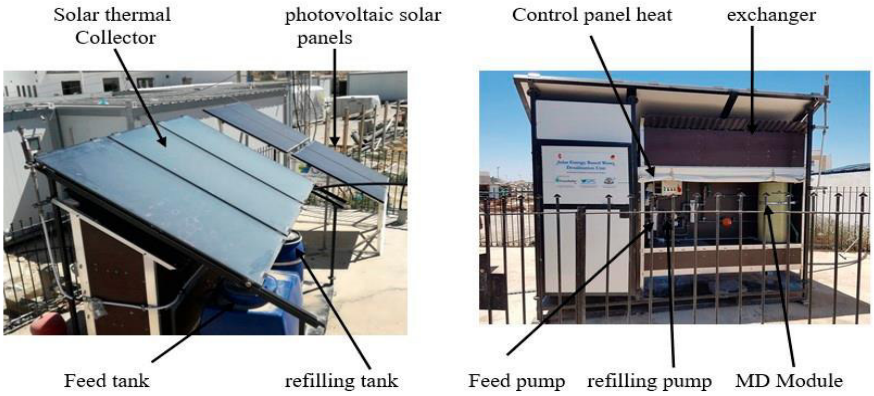
Abstract: A small-scale stand-alone solar-driven membrane desalination unit was installed at the Mechanical Department site of Kairouan University. The desalination plant is intended for autonomous operation in remote regions with a lack of electricity and drinkable water but with high solar irradiation. The desalination energy is supplied entirely by 3 solar thermal collectors offering a total area of 6 m² and the electrical auxiliary energy is supplied by a 4 PV panel, ensures the production of 1 kW with the ability to store energy generated from 2 batteries. The membrane used in this study was of the spiral wound design, which allowed for a compact arrangement besides effective internal heat recovery. The plant was tested and prepared for long-term testing in the weather conditions of Kairoun, Tunisia. The plant has been continuously operated producing as high as 15.92 L/m^2 with an approximate distillate conductivity of 1865 µS/cm. The thermal energy required by the process was in the range of 90 and 310 kWh/m^3.

Keywords: Membrane desalination; Solar collectors; Photovoltaic cells.



Graphical abstract

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Renewable energy as an auxiliary power supply in urban transportation buses, Tunisia case study

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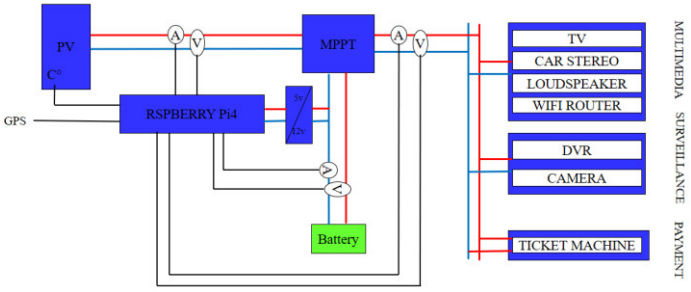
Abstract: Carbon dioxide (CO_2) produced by combustion process in conventional thermal engines contributes directly to the global warming and climate changes due to enormous quantity of greenhouse gas (GHG) emitted. On the other side, the cost of generating this propulsive energy is still very expensive for the world economy, especially with the instability of the barrel price. Today, investing in research related to the integration of renewable energy in end-use sectors is no longer a choice. Indeed, emissions regulations around the world have been geared towards finding sustainable energy resources for the transport sector. This paper presents a bibliographic study on research work related to the integration of renewable energy, mainly photovoltaic (PV) systems, in the urban transport sector. In fact, those studies discuss the efficiency of the incorporation of PV systems in the structures of urban transport buses and its contribution in the power supply process. Moreover, the paper focuses on the application of this process for the case study of a conventional diesel bus in Tunisia. The study will be carried out in collaboration with the Regional Transport Company of Kasserine taking into account different parameter of weather conditions, number of passengers and fuel consumption.

Keywords: Consumption reducing, Emission reducing, Public urban transportation, Photovoltaic energy.



Graphical abstract

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Solar Radiation Estimation Using Artificial Neural Network (RNN)

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Abstract: Knowledge of solar irradiance is essential for calculating various solar-related system performance, such as sizing and performance of renewable energy systems. The objective of this work is to develop a prediction model from real meteorological data which is based on artificial neural networks in the M'sila region. The results obtained made it possible to opt for this technique for its advantages adapted to the posed problem.

Keywords: Solar irradiation; Renewable energies; artificial neural networks (RNN); prediction.

Graphical abstract

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A validated Dunkle's C++ based CFD model to assess solar still productivity for water desalination applications

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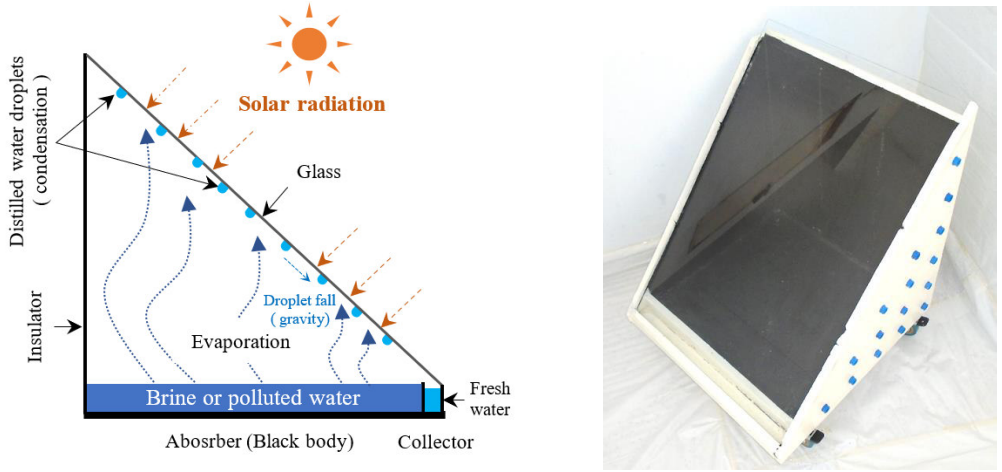
Abstract: Many countries suffer from the scarcity of healthy drinking water. Solar stills are considered as simplest technologies that can overcome this problem. In the present study, both experimental and numerical investigations of a passive solar still were conducted. The flow solution was obtained with the Fluent solver Eulerian multiphase model coupled to a developed C++ mass transfer code based on the Dunkle model. For the model validation, a grid independency analysis was conducted for a set of grids with different mesh sizes and the results were compared to test data. The deviation between the numerical results and test data does not exceed 15% which ensures the validity of the computational method. Based on the obtained results, the maximum daily water yield is about 3083.11 ml as recorded on June 15, 20. The results proved that the solar still can be an efficient device for solar desalination in Tunisia central region.

Keywords: Water desalination; Solar still; CFD, Tunisian conditions; Dunkle's based C++ model.



Graphical abstract

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Effect of Biodiesel use on Engine Performance and Exhaust Emissions

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Abstract: Biodiesel was extracted from three different individual sources: waste frying oil, palm oil, and castor oil to find out if significant differences exist among biodiesel fuels within their thermo-physical properties and engine performance characteristics and the resulted exhaust emissions. The study investigated the effect of these biodiesel properties on engine performance characteristics, to determine the appropriate biodiesel source for the best engine performance. The tested properties were: Kinematic viscosity, density, flash point, heat value, and pour point. The tested exhaust emissions elements were Oxygen, Sulfur dioxide, Carbon dioxide, Carbon monoxide, and nitrogen oxides. Engine performance characteristics under evaluation were Brake power, Brake specific fuel consumption, and the air-fuel ratio.

Keywords: Biodiesel; fuel; engine; oil.

Graphical abstract

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Design of a Low Voltage Solar Motor Fed by a Direct-Connected Photovoltaic Array for a vector control of a SynRM-based PV pumping system

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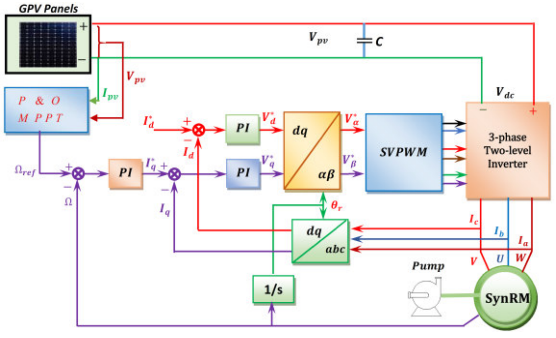
[3] *Department of Electrical Engineering, University of Larbi Tebessi, Constantine Road, 12022, Tebessa, Algeria*

Abstract: In this paper, an improved performance of a photovoltaic (PV) pumping system employing a synchronous reluctance motor (SynRM) under the change in climatic conditions is proposed. The DC-DC Boost converter, which is primarily used to increase the PV array's output power, is not include in the system. In addition, the SynRM rotor does not contain magnets and windings. The motor is designed for a low rated voltage level about 40V. Thus, a low cost solar system can be achieved. A vector-controlled SynRM motor is employed to increase the efficiency of system. The MPPT algorithm has been developed to ensure that the motor driver operates at maximum speed continuously. The aim of the MPPT control strategy is to provide an optimal reference mechanical speed for the SynRM-based PV pumping system according to the changes of the existing climatic conditions. The results are performed by using MATLAB/SimPowerSystem blocks. The performances of motor, MPPT and drive system are analyzed in different conditions as temperature and irradiation of PV array.

Key words: Synchronous reluctance motor (SynRM); Maximum power point tracking; Photovoltaic systems; Vector control; Space vector PWM.



Graphical abstract

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Tilt-Proportional Integral Derivative (TPID) Controller for a Photovoltaic System with DC-DC Converter

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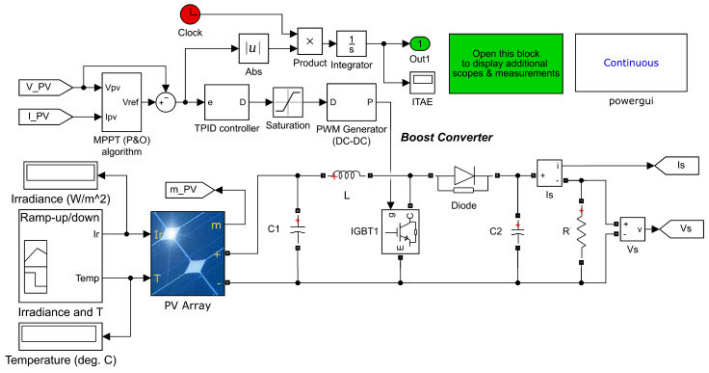
[3]*Department of Electrical Engineering, University of Larbi Tebessi, Constantine Road, 12022, Tebessa, Algeria*

Abstract: In this paper, a Tilt Proportional Integral Derivative (TPID) controller is designed to control a DC-DC boost converter in a photovoltaic system. Because of the nonlinear V-I characteristic of a PV-panel, à power electronic interface is required to obtain a desired and fixed voltage level. The objective is to optimize the controller parameters from solving the criterion Integral Time Absolute Error (ITAE) by Particle Swarm Optimization (PSO). The control strategy is applied on photovoltaic system with DC-DC converter to validate the efficiency of the proposed idea. Their performance and robustness are compared to those provided proportional integral derivative controller. The results show that the TPID controller performs better performance than the classical PID controller. The performance analysis and comparison of PID controller and TPID controller is done using MATLAB.

Keywords: TPID controller; DC-DC converter; PID controller; Photovoltaic system.



Graphical abstract

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Numerical simulations of a Solar Air Heater with a simple circulation

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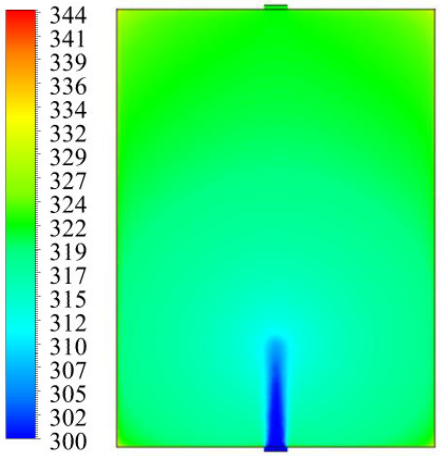
Abstract: This work is developed in our Laboratory of Electro-Mechanical Systems (LASEM) to investigate the performance of the solar air heater. This device captures solar energy and stores it for use in various industrial processes, such as heating buildings or drying the nutrient products. In order to improve the performance of the solar air heater, we are interested on the selection of the optimal model. Particularly, we focus our attention on the analyze of the meshing effect. These simulations were developed by using the commercial CFD code Ansys Fluent 17.0.

Keywords: Solar air heater; Solar energy; Ansys Fluent.



Graphical abstract

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Experimental Study of Performance of Solar Distillers

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Abstract: The abundance of seawater and solar energy in the region of Sfax located in southeastern Tunisia has led us to study experimentally the performance of solar distiller. For this reason, we fabricated four identical solar distillers in the Laboratory of Electro-Mechanic Systems (LASEM) at the National School of Engineers of Sfax (ENIS). The objective of the present research is to study experimentally the effect of some parameters on its performance under the semi-arid climate of the Sfax region. The present work shows that the distillate production is influenced by these parameters.

Keywords: Solar distiller; Productivity; Distillate water; Performance; Desalination.

Graphical abstract

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2D approach for the meshing choice of a zephyr vertical axis wind turbine modeling

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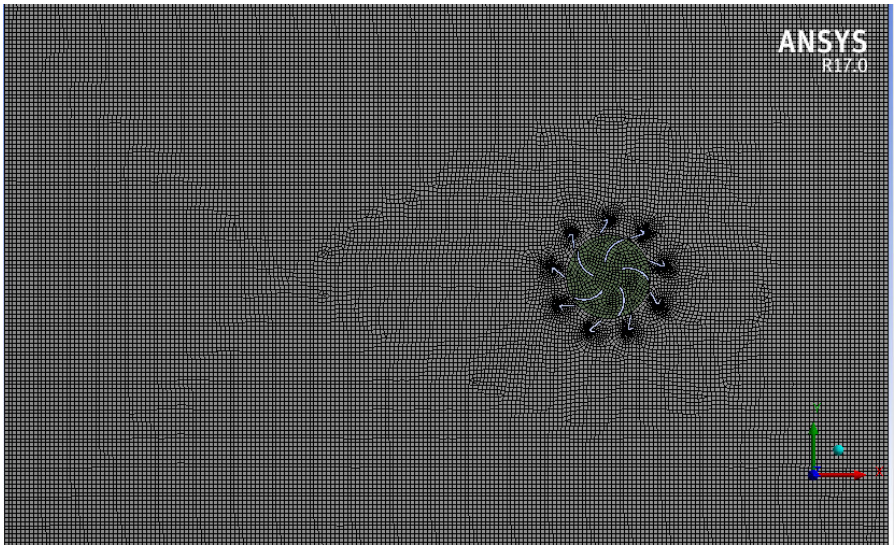
Abstract: This work was developed in our Laboratory of Electro-Mechanical Systems (LASEM) to investigate the aerodynamic performance of the zephyr vertical axis turbine (VAWT). In particular, 2D approach has been developed to choose the best mesh for modeling the aerodynamic structure of the wind turbine. Our numerical results have been compared with experimental results found from the literature. The good agreement confirms the numerical method considered.

Keywords: VAWT; Zephyr; aerodynamic; meshing.



Graphical abstract

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Numerical study of a darrieus wind turbine

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Abstract: Recently, there has been strong growth in the development and exploitation ofrenewable energies with the aim of reducing dependence on fossil fuels for healthy energy production, ensuring the protection of the planet, and essentially increasing the share of global renewable energy in global energy production. Thus, current energy systems are converted into 100% natural renewable energy power systems, renewable atreduced cost. The development of wind power is very important to solve the energycrisis, reduce environmental pollution and adjust the energy structure. The Darrieus windturbine (DWT) is a vertical-axis wind turbine that uses the lift forces of the wind, basedon a rotor rotating around a fixed rod. This type does needs no orientation mechanismwith respect to wind direction, due to the fact that this rotor can take wind from every direction in contrast to others wind turbine type. Also, DWT makes very little noise privileging their placement near populated areas. Those undisputed advantages seem to be the reason why this model is receiving an attention from the industry. Current work aims to enhance the aerodynamic performance of the Darrieus wind turbine, mainly the output power coefficient, to effect the rotor efficiency and to increase the power capture. The numerical study focused on a three-dimensional model in both stationary and unsteady approaches. The numerical model was validated using wind tunnel tests.

Keywords: Energy; Darrieus wind turbine; aerodynamic performance; wind tunnel.

Graphical abstract

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Sustainable environment

Durable nanocomposite coatings: A comparative study of PDMS-based doped nanoparticles for the preservation of heritage materials

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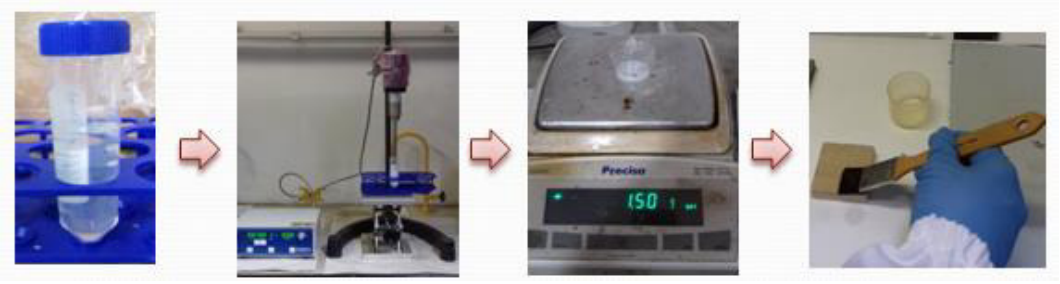
Abstract: Nowadays, the development of durable protective coatings receives more attention in the field of preservation of heritage materials. Hence, this study was performed to develop a multi-functional and durable coating to protect highly porous stone materials notably, Lecce stone. For this purpose, Gd/Ag-doped-TiO_2-PDMS nanocomposites (PDMS, polydimethylsiloxane used as the binder) were elaborated and the performances of obtained coatings were studied through different experimental analyses. Particularly, the study was intended to assess the durability properties of the developed coatings. Ageing tests were carried out to assess the long-term efficiency (durability) of the developed protective coatings. Hence, nanocomposite coatings underwent artificial solar ageing by a 300-W OSRAM Ultravitalux light with an irradiation period that lasted 1000 h. Other series of treated samples remained in the laboratory in a humid environment (RH > 80 %, T = 22 ± 3 ◦C) for two years (from 2019 to 2021). After ageing cycles, the photodegradation performances of different applied coatings were investigated through the degradation of methylene blue dye. The durability of thin films from an antimicrobial perspective was evaluated by following the inhibition effectiveness of each coating after one year of incubation.

Keywords: Nanocomposite coating; PDMS, Ag-doped TiO_2; Gd-doped TiO_2; Self-cleaning effect; Antimicrobial activity, durable protective coatings; Lecce stone.



Graphical abstract

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Simulation of thermal effect in underground power transmission cable

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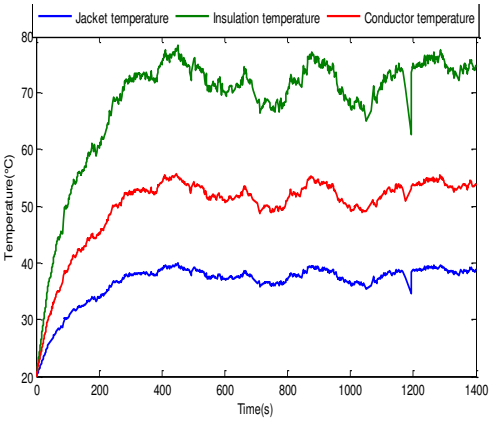
Abstract: Underground and submarine cables are used into electrical power transmission network to transport an important power flow with different corresponding voltage levels. Several research and studies are conducted on thermal phenomena in underground power transmission cables because of their effects on materials and cable isolation and the environment, and how these phenomena behave in case of damage. In this paper, we present the simulation results of underground power cable by displaying thermal and heat transfer between different layers of cable with current loading variation condition, the performance evaluation process of the high voltage cable considering the thermal distribution inside the cable has been a major of interest to find the corresponding maximum current carrying capacity (ampacity).

Keywords: Heat; Matlab; power cable; thermal; underground.



Graphical abstract

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Smart mobile unit for plastic waste recycling

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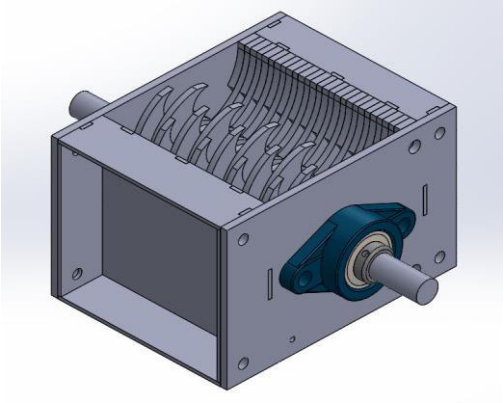
Abstract: Regarding the large quantities of plastic waste that invade our daily lives, the idea of this project was inspired an intelligent mobile unit for collecting Polyethylene terephthalate wastes. The authors' vision is to offer a small, simple. Yet, an efficient collection system to help the local community members eliminate the culture of helplessness in the face of the large quantities of plastics. Building such a project with a minimal budget was a huge challenge to develop an intelligent collection system that would allow the creation of small and medium enterprises acting in this field. During the concept phase of this unit, the massive presence in our daily lives of PET, HDPE, LDPE, and PP led to our choice. The implementation of an innovative optical detection system in our unit, along with its sorting system and solar energy, led to the creation of a new intelligent collection-recycling unit that will -undoubtedly- improve people's lives and contribute to a sustainable environment.

Keywords: Plastic recycling; Polyethylene terephthalate; intelligent collection system; optical system; sorting system.



Graphical abstract

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Modelling and simulation

Seismic Behavior of Typical Rc Building Using Different Lateral Load Models In Non Linear Static Pushover Analysis

Radia Touati[1], Louzai Amar[2], Ouanani Mouloud[1,*] and Soumia Aouissi[1]

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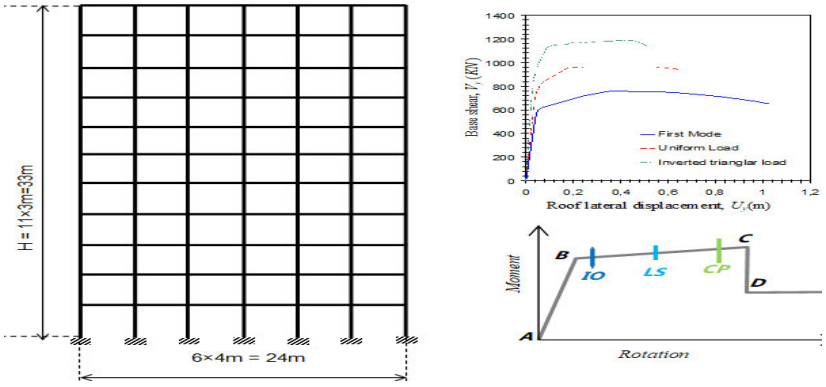
Abstract: The main objective of this work is to evaluate the seismic behavior of typical Reinforced Concrete (RC) building constructed in a seismically active western region of Algeria subjected to strong earthquake using different lateral load models in nonlinear static pushover technique. The choice of lateral load distribution is an essential parameter in order to assess the nonlinear seismic response and vulnerability of structures. In the perspective of this study, three lateral load patterns are proposed: 1) Elastic first mode lateral load pattern, 2) Uniform lateral load pattern and 3) Inverted triangular lateral load pattern. The results showed that static pushover analysis with different lateral load models is an efficient and quick method to study the nonlinear seismic behavior of structures under seismic loads compared to the inelastic dynamic analysis which is complex and time consuming and this method provides an inexpensive and effective alternative for engineers.

Keywords: Sismic behavior; RC building; Elastic first mode lateral load pattern; Uniform lateral load pattern; Inverted triangular lateral load pattern; Nonlinear static pushover analyse.



Graphical abstract

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Seismic Performance Evaluation of Typical Box Girder Bridge Using Nonlinear Static Pushover Analyses Based on Upper-Bound Distribution

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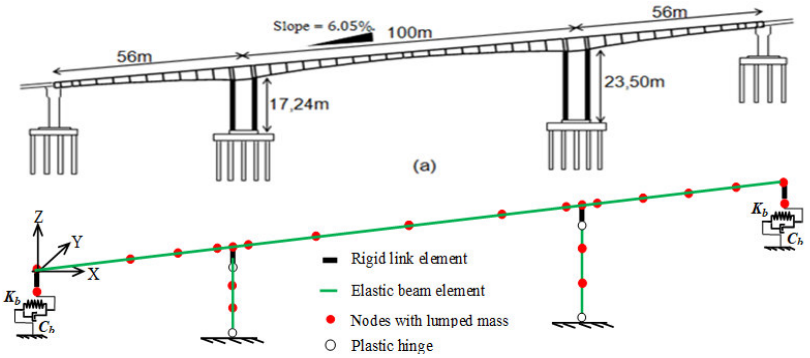
Abstract: The evaluation of seismic performance of box bridges using nonlinear static pushover analyses varies according to the accuracy and efficiency of the lateral load distribution model, and one of the most popular models used is the upper-bound distribution. This study aims to compare the results of non-linear static analysis using three different lateral load distributions: 1) Elastic first mode lateral load pattern, 2) Uniform lateral load pattern and 3) upper-bound lateral load pattern. The bridge is subjected separately to predifined three different lateral forces distributed over the span of the studied bridge. Comparisons of results by nonlinear static pushover analyses are performed in terms of capacity curves, overstrength and global ductility values for bridge piers.

Keywords: Seismic performance ; Box girder bridge ; Elastic first mode lateral load pattern; Uniform lateral load pattern; upper-bound lateral load pattern.



Graphical abstract

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Combined effect of viscous dissipation and Joule heating in MHD nanofluid flow within parallel plates

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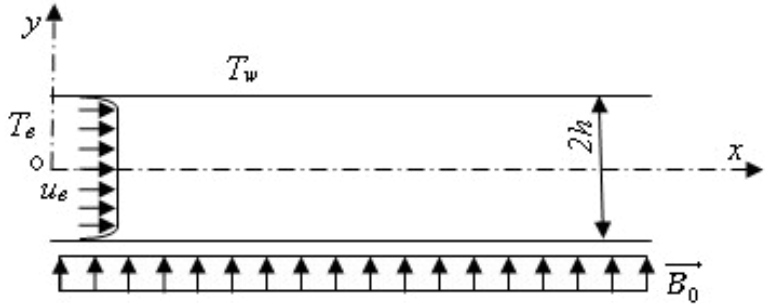
Abstract: In this numerical simulation, we studied the convective heat transfer of a Newtonian nanofluid flows within two parallel plates under the influence of a fixed magnetic field perpendicular to the fluid flow direction. The thermal boundary conditions applied in this study is a constant temperature imposed at the wall. Moreover, we have considered in the energy equation two additional factors, namely the viscous dissipation represented by the Brinkman number and the heating by the Joule effect. The results showed that the magnetic field has a significant effect on both the velocity profile and the heat exchange coefficient, especially when both of viscous dissipation and heat induced Joule effect are onsidered.

Keywords: Heat transfer; parallels plates; MHD nanofluid flow; Simulation numerique; viscous dissipation; Joule heating.



Graphical abstract

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Cooling by natural convection of a heat source by means of a square cavity filled with nanofluid

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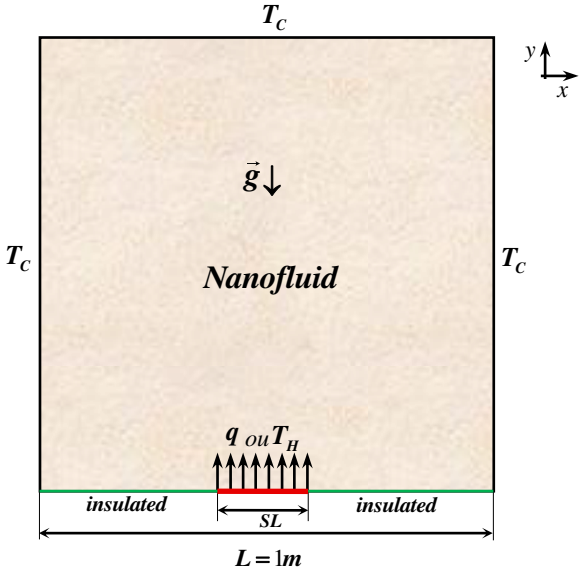
Abstract: In this numerical work, the cooling of a heat source (under *q-imposed* or *T-imposed*) placed at the bottom of a square cavity filled with water-based nanofluid is studied. Four types of Nanoparticles were assumed for six lengths of the source placed in the center of the bottom wall. We were interested in the effects of Rayleigh number (*Ra*), concentration of nanoparticles (ϕ), source length (*SL*) in addition to the condition imposed on the source. The results focus on dynamic (ψ) and thermal (θ) fields, local Nusselt (Nu_L) and mean Nusselt (Nu_m). Many important observations have been recorded, in particular the disappearance of the effect of the thermal condition on the source at high *Ra* and ϕ.

Keywords: Natural convection; Rayeligh; Source length; Nanofluid; Thermal condition.



Graphical abstract

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Numerical study on the improvement of the cooling of a high voltage transformer by the use of nanofluids

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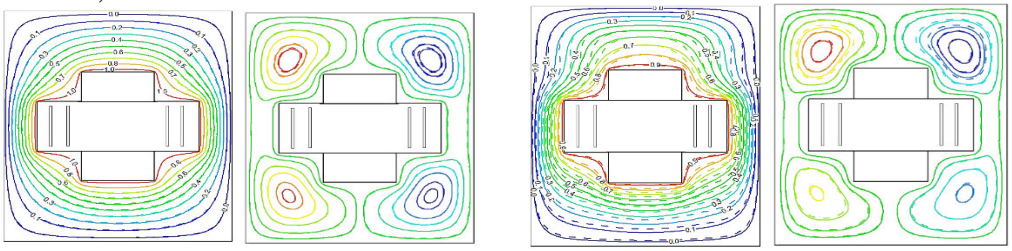
Abstract: This article has been to make available modern methodologies for both industry and academia, also highlighting the importance of using nanofluids for cooling high power transformers. The numerical study on the improvement of the cooling of a high voltage transformer by the use of nanofluids has carried out. Natural convection analyzed in a tank with a temperature source encountered inside and charged with a mineral oil-barium titanate nanoparticle. This article explores the influences of aspects such as the thermal Rayleigh number, and the solid volume fraction on the thermal efficiency of the tank. The results show that the cooling change related to the nanoparticle volume fraction used and differs from the low and high Rayleigh thermal numbers. The results were presented in terms of heat transfer rate as a function of the thermal Rayleigh number ($Ra_t = 10^3$ and 10^6), and of the solid volume fraction of the nanoparticles ($0 \leq \varphi < 10\%$). The results show that increasing the solid volume fraction of the nanoparticles ($\varphi = 10\%$) leads to an increase in the effective conductivity of the working fluid and consequently the improvement of the heat transfer rate by approximately ≈ 10% per compared to the case of the base fluid.

Keywords: natural convection; tank enclosure; thermal Rayleigh numbers; nanofluid; volume fraction.



Graphical abstract

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Study of the polyurethane and phenolic foam as an air duct material

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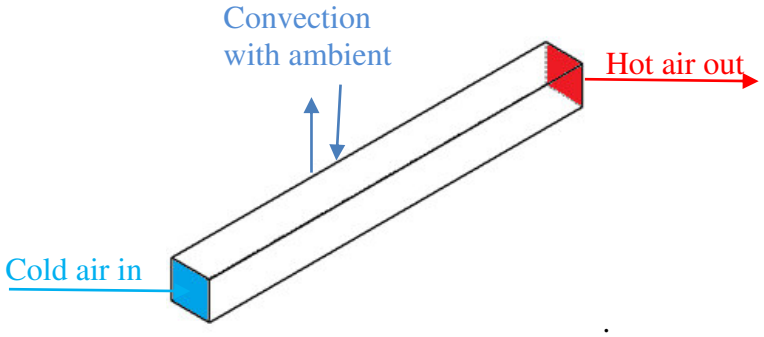
Abstract: Wide ranges of materials are used in the heating, ventilation and air conditioning duct systems. Big parts of these materials are metallic with a high ability to affect heat exchanging and therefore increase the energy consumption. This work aims to compar the numerical results for a metallic material, which is the galvanized-steel and non-metallic material, which is the Polyurethane and phenolic foam in terms of heat gain.

Keywords: Duct; HVAC; Heat gain.



Graphical abstract

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Dynamic modeling of the gearbox system for tooth crack detection using the Shewhart control chart technique

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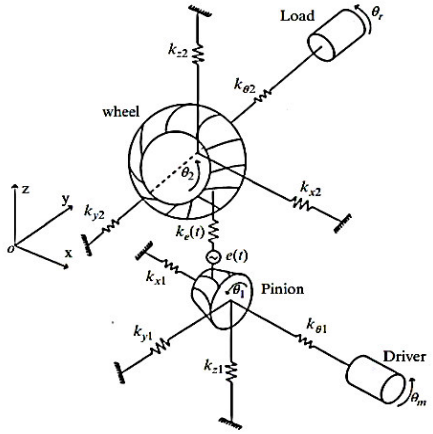
Abstract: Dynamic models and simulation data for condition monitoring and detecting faults have long been used in gear systems. This research presents a system for fault detection in the dynamic model of a gear system using one of the Statistical Quality Control charts(SQCs), commonly known as the Shewhart chart. Initially, the raw simulation vibration signals are acquired from the dynamic model of the single-stage bevel gear. Next, white Gaussian noise (WGN) was added to simulate gear signal work from real-life conditions. Then, the time-domain analysis is performed for the vibration signals under healthy and faulty conditions to extract the Standard Deviation (STD) feature as a statistical monitor indicator. Finally, the Shewhart control chart was designed and tested based on the standard deviation feature to monitor and detect the crack fault in the pinion. The control chart has proven successful in monitoring the healthy state of the gear system and deterioration level detection of pinion crack propagation.

Keywords: Gearbox system; Dynamic modeling; Fault detection; Shewhart control chart.



Graphical abstract

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Numerical Simulation of HV Insulators String Using "Comsol Multiphysics"

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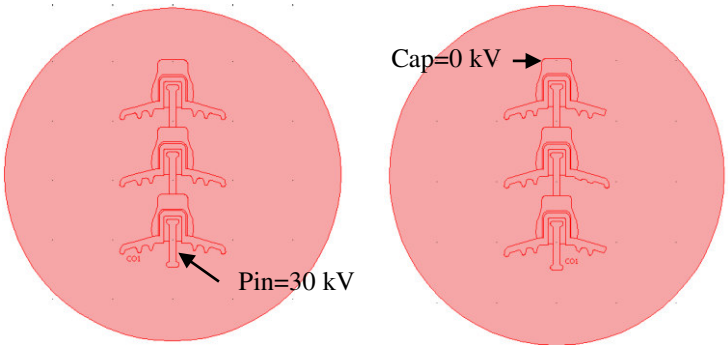
Abstract: Electrical insulators commonly known as suspension insulators can be used individually, but usually form part of a string to support an electrical conductor from a supporting structure. In this work, using COMSOL Multiphysics software, based on the finite element method (FEM), to study the potential and electric field distributions along the insulating surface of a string of high voltage 175 CTV insulators, widely used by the national electricity and gas company (Sonelgaz-Algeria) under AC voltage. We considered clean and destroyed cases. The study was carried out We used 2D electrostatic simulation in the AC/DC module. Numerical results showed a good agreement.

Keywords: String Insulators; destroyed insulator; Electric field; Electrical potential; Comsol.



Graphical abstract

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Prediction of Breakdown Voltage in Point-Insulating Barrier-Plane System Using Experimental Design Method (DOE)

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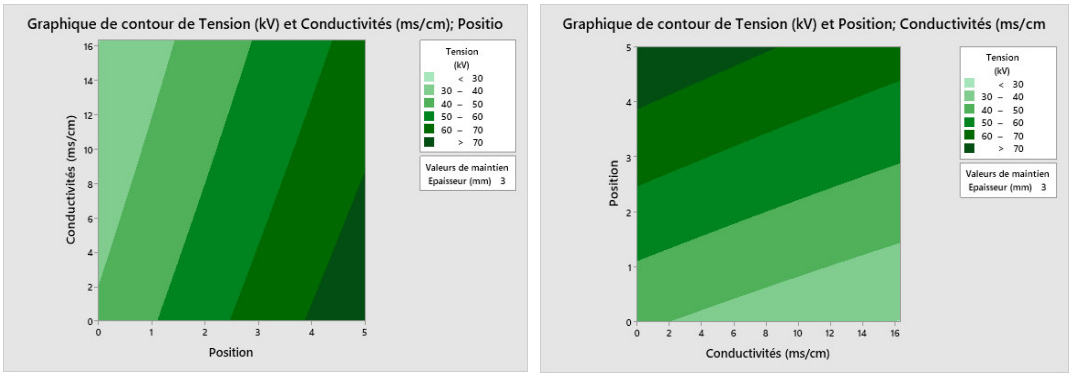
Abstract: Several industrial sectors such as the installation and protection of energy transmission networks. The introduction of an insulating barrier significantly changes the breakdown voltage and improves the rigidity of a system without increasing the inter-electrode distance. Prediction of the breakdown voltage of a point-polluted barrier-point configuration is offered in this work by a numerical model based on the experimental design method (DOE). The results showed us that the location of the barrier is the most influential factor in the prediction of breakdown voltage. The calculated results are in good agreement with the experimental results.

Keywords: Point-barrier-plane; Breakdown voltage; Pollution; Experimental design; Prediction.



Graphical abstract

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Shunt Active Power Filter of Currents Harmonics in the Low Voltage Electrical Network

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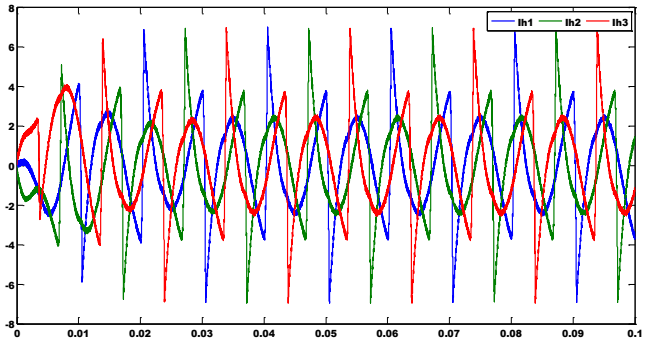
[2] *Department of Mechanical Engineering, University of M'sila, Faculty of Technology, M'sila, Algeria*

[3] *Department of Electrical Engineering, Faculty of engineer Sciences, University of Boumerdes, Boumerdes, Algeria*

Abstract: In electrical distribution networks, the problem of harmonic pollution is becoming more and more worrying with the increase in the use of non-linear loads. The present work consists of the study of the dépollution of the electrical network by the compensation of harmonic current perturbation and improvement of current quality based on the three-phase four-wire parallel active filter. The results obtained by Matlab/simulation environment demonstrate the Importance of this work in harmonic filtering and reactive power compensation and show that is considered a modern solution to compensate for perturbation in the grid utility caused by nonlinear loads and offer good results for the THD of the current on the source side.

Keywords: Active Power Filter; Three-phase four wire Systems; Harmonic Compensation; Nonlinear loads.



Graphical abstract

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Numerical study of Banki micro hydro-turbine

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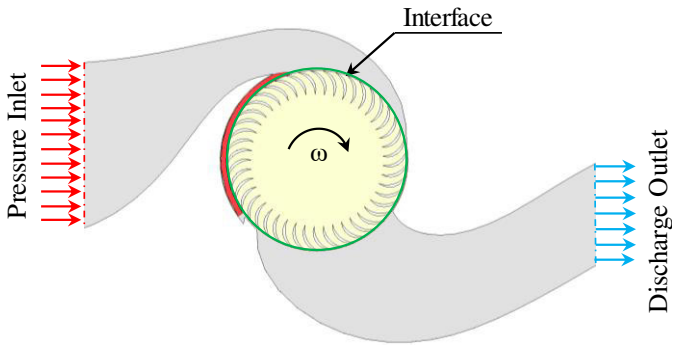
[2]*Università degli Studi di Palermo, V.le delle Scienze, 90128 Palermo, Italy*

Abstract: Banki micro hydro-turbine is a cross flow hydro-turbine, which converts the potential energy of the waterfall into mechanical energy, in order to generate electricity. In this paper, the study of a new simple Banki turbine with positive outlet pressure is carried out using the commercial software Ansys CFX 17.0. The performance analysis of the considered turbine was performed based on the interface model effect. Two possible models are accessible in ANSYS CFX solver: Frozen Rotor and Transient Rotor-Stator. A comparison with the experimental results performed the validation of the numerical method. The present study indicated that the Frozen Rotor model is sufficient to predict the efficiency of the considered turbine but the Transient Rotor-Stator model presents a good match with experimental data.

Keywords: Banki micro hydro-turbin; positive outlet pressure; performance; interface model; Frozen Rotor; Transient Rotor-Stator.



Graphical abstract

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Numerical simulation of the heat transfer through a Kevlar fiber/epoxy plain woven composite

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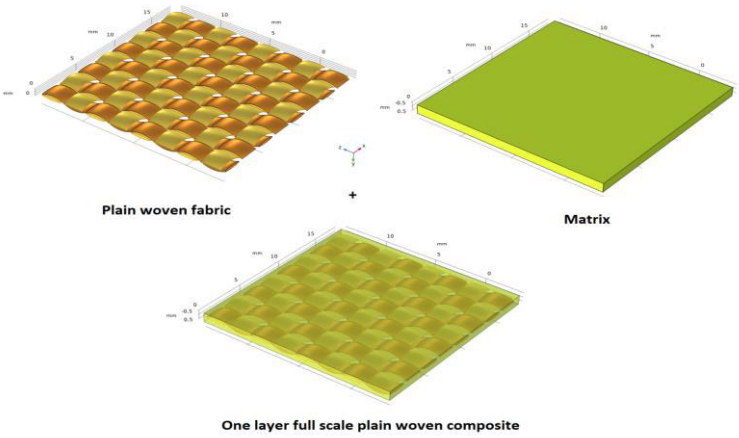
Abstract: Quantifying the material characteristics of each individual lamina is important in order to analyze components constructed of laminated composites. The outstanding in-plane strength and structural stability of kevlar fiber/epoxy plain-woven composites, as well as their low thermal conductivity and good insulating qualities, have led to their widespread use in a variety of sectors. The simpler one-layer woven model was introduced due to the complex structure of n-layer woven composites, which caused challenging convergence and a much longer calculation time in FEA.

Keywords: heat conduction; thermal behavior; Kevlar fiber/epoxy composite; FEA.



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Graphical abstract

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A DOUBLE DIRECTOR 3D SHELL FORMULATION FOR MEE SHELL

Hajer ELLOUZ[1], Hanen JRAD[1], Mondher WALI[1], Fakhreddine DAMMAK[1]

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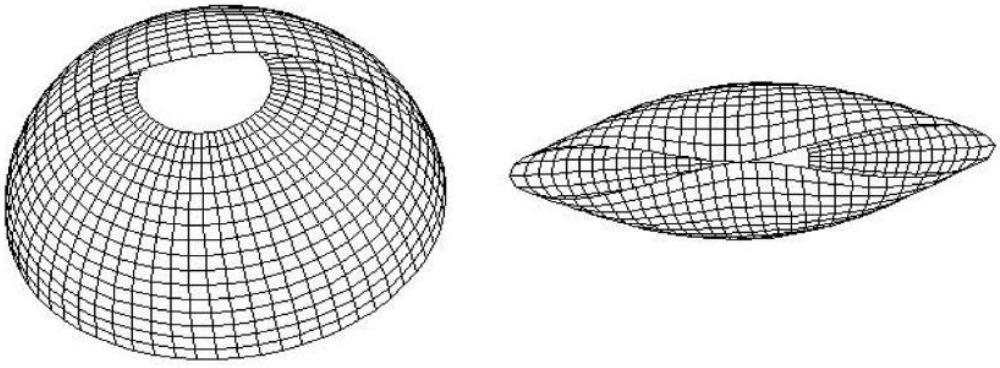
Abstract: This paper is concerned with a magneto-electro-elastic (MEE) shell element to analyze smart structures. The finite element formulation is based on discrete double directors shell elements. This method is applicable to the analysis of laminated shells with integrated magnetostrictif and piezoelectric layers. To remove the shear correction factor and enhance the accuracy of transverse shear stresses, the third-order shear deformation theory presented in the present method. The number of nodes is four nodes with nine nodal degrees of freedoms: three displacements, four rotations, one electric potential and one magnetic potential.

Keywords: Magneto-electro-elastic shells, smart materials, double directors' shell element.



Initial and deformed geometry of hemisphercall shell

Graphical abstract

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Experimental testing methods

ATTENTION-BASED CNN-CONVLSTM FOR HANDWRITTEN ARABIC WORD EXTRACTION

Takwa Ben Aïcha Gader[1] and Afef Kacem Echi[2]

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Abstract: Word extraction is one of the most critical steps in handwritten recognition systems. It is challenging for many reasons, such as the variability of handwritten writing styles, touching and overlapping characters, skewness problems, diacritics, ascenders, and descenders' presence. In this work, we propose a deep-learning-based approach for handwritten Arabic word extraction. We used an Attention-based CNN-ConvLSTM (Convolutional Long Short-term Memory) followed by a CTC (Connectionist Temporal Classification) function. Firstly, the text-line input image's essential features are extracted using Attention-based Convolutional Neural Networks (CNN). The extracted features and the text line's transcription are then passed to a ConvLSTM to learn a mapping between them. Finally, we used a CTC to learn the alignment between text-line images and their transcription automatically. We tested the proposed model on a complex dataset known as KFUPM Handwritten Arabic Text (KHATT \cite{khatt}). It consists of complex patterns of handwritten Arabic text-lines. The experimental results show an apparent efficiency of the used combination, where we ended up with an extraction success rate of 91.7\%.

Keywords: Attention mechanism, ConvLSTM, CTC, Deep-learning, Handwritten Arabic word extraction.

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Degradation resistance of Sanicro-28 steel and graphite in contact with industrial phosphoric acid containing an oxidizing agent

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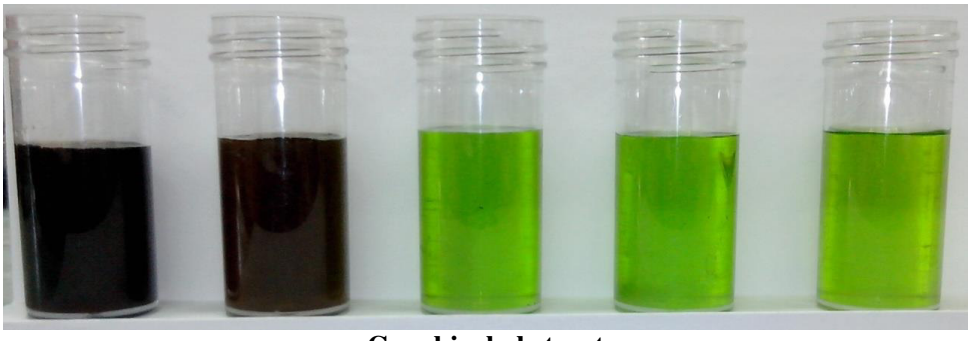
Abstract: Phosphoric acid (PA) is one of the central chemicals that has a numerous use-fulness in several industries, agriculture, and products that we use in our daily lives. Phosphoric acid is manufactured from phosphate rock through thermal process or wet process. The composition of natural phosphate rock is extremely complex and contains a very large type of impurities. In addition to the mineral impurities, the phosphate rock as well as the resulting phosphoric acid also contain organic matter. Phosphoric acid (28% P_2O_5) can be marketed only in a concentration of ap-proximately 54% P_2O_5. The elimination of undesirable chemical materials is detrimental for the international commercialization of phosphoric acid. Therefore, a purification process is regularly performed to remove organic contaminants through several process. In particular, Tunisian Chemical Group (GCT) has developed a technically and economically viable process by using oxidant for the decontamination procedure. The purification process is performed through special equipment composed from resistant materials such as stainless steel, and graphite, etc. The present study was carried out to investigate the impact of different doses of the oxidizing agent on Sanicro-28 stainless and the graphite and mainly its resistance to degradation when mixed with the Phosphoric acid media containing an oxidizing agent introduced at different doses, at 85°C through static and dynamic immersion tests. Results provided that since the oxidizing agent dose did not reach a limit value, both materials present good performances to degradation process against PA and oxidizing agent mixtures at 85°C.

Keywords: Sanicro-28; graphite; industrial phosphoric acid; degradation; static immersion; dynamic immersion.



Graphical abstract

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Sintering and characterization of titanium dioxide bioceramic

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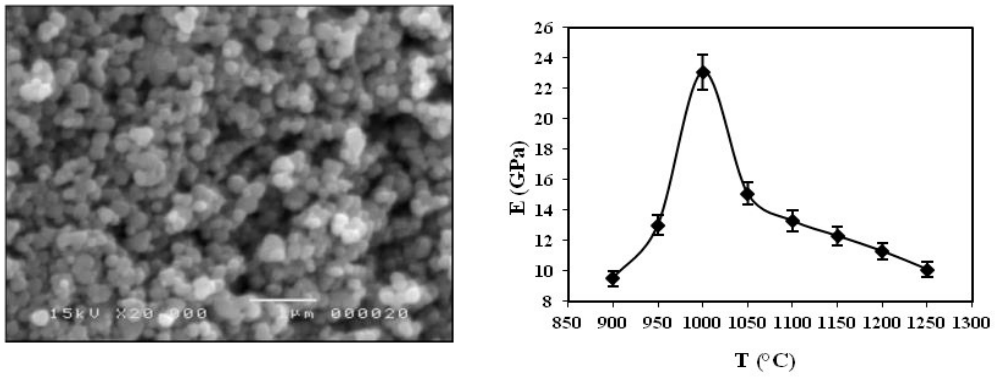
Abstract: Titanium dioxide attitude and performances were investigated. The behavior study of titanium dioxide before and after sintering process was conducted. This study was performed by dilatometry, differential thermal analysis and X-ray diffraction. Titanium dioxide mechanical properties marked up by the sintering temperature. Thus, optimums values were reached at 1000°C. Whereas, the maximum of rupture strength was 7MPa and 340Hv as a Vickers hardness. While, the optimum of shear modulus attained 10.5 GPa and the maximum of Young's modulus was about 23.1GPa. Beyond 1000°C, the mechanical behavior and the densification of titanium dioxide are delayed due to the allotropic transformation of titanium dioxide. This latter has been transformed from anatase to rutile phase. This transformation was completely achieved below sintering at 1000°C for 300 minutes.

Keywords: Sintering; Mechanical performances; Anatase; Titanium dioxide; Rutile.



Graphical abstract

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Investigating the sintering effect on the mechanical performances of natural hydroxyapatite derived from bone samples for biomedical application

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Abstract: This study aimed to investigate the mechanical performance of the hydroxyapatite extracted from bovine bones after a sintering process which lies in the range [1000 °C -1400 °C]. The treated samples were examined by using the Brazilian test, Vickers hardness and X-ray diffraction XRD analysis. From the main results, it was found that the best mechanical properties were obtained after sintering at 1300 °C for 2 hours. At higher sintering temperature, both densification and mechanical properties were hindered due to the dehydroxylation of Hydroxyapatite.

Keywords: Sintering; mechanical performances; hydroxyapatite; dihydroxylation.

Graphical abstract

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- Advanced prediction capabilities of infrastructure deterioration.
- Interoperability aspects to optimize infrastructure system operations.
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