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Book of Abstracts

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ABOUT NCGE'24

The second National Conference on Green Energy (NCGE'24) is a peer-reviewed conference on Renewable and Sustainable Energy held at the University of Boumerdes during December 15-16, 2024. The conference serves as an exclusive forum for researchers, academics and industry professionals to present and discuss the latest technological advancement as well as future directions and trends in the field of Renewable and Sustainable Energy.

The conference includes several keynote lectures, academic discussions, oral and poster presentations, technical workshops and a social event that will provide huge networking opportunities for all the attendees.

Thank you for joining us at NCGE'24 to be a part of this important event shaping the future of Renewable and Sustainable Energy.

Contents

Paper ID : 4

Prototype Implementation of a Distributed Renewable Energy Micro-Power Plants

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Abstract

In an increasingly pressing ecological context, this paper makes a contribution to the field of renewable energy. The main objective of this project is to manage the production of electricity from renewable energies (wind and photovoltaic) without creating disturbances in the network, and to absorb them if they occur through load variation over time. We are developing strategies to control micropower plants so that each one produces an exact amount of energy in real time to keep pace with variations in consumption and overcome the limitations of weather variations.

Keywords

Renewble energy - Micro power plant - Wind energy - Solar energy - Wind turbine emulator

Paper ID : 8

An Improved Parameter Identification of PEM Fuel Cells Using Puma Optimization Algorithm

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Abstract

The focus of this paper is on the parameter identification of Proton Exchange Membrane (PEM) fuel cells. To determine the optimal parameters for the system, a puma optimization algorithm (POA) is employed which uses a fitness function based on the Integral of the Squared Error (ISE). Experiments are carried out to prove the correctness of the proposed approach. This paper also provides a comparison of results with existing approaches available in the literature and argues that the methods reported here are much more effective in estimating the parameters of a PEM fuel cell.

Keywords

PEM fuel cell - modelling - identification - metaheuristic algorithms - optimization.

Paper ID : 9

Improvement of Paraffin Melting Process Using Additional Metals Algorithm

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Abstract

Phase change thermal storage is an innovative and promising technology for saving energy. It is one of the new areas of research because it provides the solution to problems related between the provided and the required energies. Paraffin is a common phase change material (PCM) that used in many applications in thermal energy storage (TES) systems. However, the main disadvantage is their low thermal conductivities. However, using metallic additives to improve effective thermal conductivity of PCM can lead to decreasing effective heat capacity and the thermal energy stored. An experimental study was carried out to analyze the thermal behavior of the paraffin melting in a thermal cavity integrating different metals (zamak, aluminum and copper) with different configuration. The originality of study is to try to predict the best duo that respects both the improvement of thermal conductivity and energy stored. The experiments show that adding aluminum perforated plate in paraffin accelerates the melting process by about 19% and increases the energy stored by 5.18%.

Keywords

Experimental study - PCM - effective thermal - conductivity - energy stored.

Paper ID : 11

Ab-initio Study of Optoelectronic and Elastic Properties of Halide Double Perovskite Cs2BiAgBr6

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Abstract

The present study reports on the electronic, optical and elastic properties of Cs2AgBiBr6 halide double perovskite using the full potential linearized augmented plane wave method (FP-LAPW). The generalized gradient approximation (GGA) and the TransBlaha modified Becke-Johnson exchange potential (mBJ) were applied to improve the band structure and optical properties for this material. Good agreement with experiment for lattice parameters demonstrates the high precision of our approach, also the elastic and mechanical properties indicate that Cs2AgBiBr6 have a ductile and anisotropic nature. The band structure calculations reveal semiconductor character with an indirect band gap $(2.02\ eV)$ and maximum absorption in the visible spectrum $(104 - 105cm - 1)$ very appreciated for photovoltaic and optoelectronic.

Keywords

Halide Double Perovskite - FP-LAPW - GGA - mBJ.

Paper ID : 13

Modeling in MATLAB/SIMULINK of a Wind Turbine Connected to a Doubly-Fed Induction Generator

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Abstract

This work concerns, the modeling of a wind turbine system using a wind turbine with a horizontal axis a variable speed connected to a Doubly-Fed Induction Generator (DFIG). We designed a control that allowed us to maximize the received power. This models was developed in Matlab /Simulink to analyze the performance of the wind system.

Keywords

Wind turbine - DFIG - modeling - active and reactive power.

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Paper ID : 14

Etude et Conception d'un Banc D'essais pour un Émulateur Éolien de Petite Puissance

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Résumé

Dans ce travail, les auteurs présentent un émulateur éolien à petite échelle basé sur un moteur asynchrone et un variateur de vitesse. Les performances aérodynamiques et la méthode de calcul du coefficient de puissance de la turbine éolienne sont déterminées avec le programme PropID. Le mode opératoire du banc d'essai est expliqué à l'aide des équations et des schémas synoptiques. Les résultats théoriques sont compares à ceux issus des relevés expérimentaux.

Mots-clés

Emulateur éolien - Variateur de vitesse - Simulateur HIL - Energies renouvelables.

Paper ID : 15

Impact of Cooling Rate on Structure and Hardness of 30crmnti Steel before and after Carburizing Treatment

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Abstract

The aim of our work is to examine the effect of cooling rate on the structure and hardness of 30CrMnTi steel before and after carburizing, using Jominy specimens. Three types of specimen were analyzed: E1 (untreated), E2 (austenitized and end-hardened) and E3 (case-hardened then end-hardened). Metallographic analyses show that the untreated steel exhibits globular pearlite with a uniform hardness of 195 HV in all zones. For specimen E2, maximum hardness (567 HV) is observed at 1.5 mm from the bottom surface, with a martensite and bainite structure, while it decreases to 258 HV at 95 mm, where the structure consists of ferrite and pearlite. By contrast, specimen E3 (carburized and end-hardened) gives a maximum hardness of 868 HV at 1.5 mm, due to the formation of martensite + bainite+Fe3C, where it progressively decreases with greater Jominy distance. Finally, the cooling rate has a major impact on the structure and hardness of 30CrMnTi steel.

Keywords

30CrMnTi - Jominy test - carburization - structure - hardness.

Paper ID : 17

Synthesis of Supported Metal Oxide Catalysts for Natural Gas Conversion

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Abstract

This study is set within the framework of the ongoing energy transition, which involves tha gradual substitution of non-renewable fossil fuels with renewable feedstocks for the production of chemicals and fuels. During this transitional phase, fossil sources, particularly natural gas, play a pivotal role, as highlighted by recent energy outlooks. A study on the use of metal oxide catalysts for various reactions has been conducted, with a focus on the oxidative dehydrogenation of ethane (ODHE) using NiO/alumina catalysts. The relationship between the catalytic performance of these catalysts and their preparation methods has been investigated. To optimize catalytic performance, selective supported NiO catalysts for ODHE to ethylene were synthesized by fine-tuning synthesis parameters. The catalysts were characterized using a range of physicochemical techniques, including X-ray diffraction (XRD), nitrogen adsorption (N_2-adsorption) temperature-programmed reduction (TPR) and X-ray photoelectron spectroscopy (XPS). It was found that both that the preparation method significantly affects the catalytic performance of nickel oxide. Catalysts with strong Ni-support interaction and low reducibility exhibited the highest selectivity towards ethylene, while those with weaker interactions were less selective for the olefin. The mechano-chemical synthesis of NiO/alumina catalysts or the addition of oxalic acid during preparation was shown to negatively impact olefin formation. The influence of structural and surface properties on ethane ODHE, particularly on ethylene selectivity, is also discussed in detail.

Keywords

ODH of ethane - nickel - NiO-support interaction - ethylene.

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Paper ID : 19

Control of BLDC Motor Speed for Pumping Systems Using Fuzzy Logic-PI

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Abstract

The use of Brushless Direct Current Motors (BLDC) in industrial applications is increasing due to their high efficiency and reliability. However, controlling the speed of these motors, particularly in pumping applications, presents challenges due to their nonlinear nature and parameter uncertainties. To achieve superior speed control in such scenarios, the use of a fuzzy logic controller (FLC), known for its ability to effectively handle uncertainties and nonlinear systems. This research aims to design and analyze the performance of FLC for controlling the speed of a BLDC motor used in a pumping application using Matlab/Simulink. The performance of the FLC is compared with traditional control techniques in terms of time response and stability.

Keywords

BLDC motor - Pumping system - fuzzy logic-based - PI-controller - Matlab/Simulink.

Paper ID : 21

Design of Fuzzy-Sliding Mode and Comparison with Different Modes for MPPT Connected to a Load

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Abstract

This research discusses the importance of comparing maximum power point tracking (MPPT) technologies in renewable energy systems, especially in photovoltaic (PV) systems. The goal is to study and compare four MPPT technologies: perturb and Observe ($P\&O$), Fuzzy Logic Control (FLC), slip mode control (SMC), and fuzzy sliding mode control (FSMC). The photoelectric model and DC-DC power adapter are designed in the MATLAB/Simulink simpler Systems toolbox and the MPPT algorithms are tested under different operating conditions to analyze the performance and limitations of each algorithm. The results are presented through graphs, highlighting the strengths, weaknesses of each technique; the results and discussion include a comparison of the performance of the techniques, focusing on efficiency, convergence time, stability, and durability. The paper concludes with a summary and recommendations for choosing the most suitable MPPT technique.

Keywords

Photovoltaic (PV) - Maximum power point tracking (MPPT) - Fuzzy logic control (FLC) - Sliding mode control (SMC) - Fuzzy-sliding mode control (FSMC).

Paper ID : 24

Analyse CFD de L'écoulement du Peroxide D'hydrogène dans un Lit Catalytique d'un Propulseur à Monergol de 20N

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Résumé

Cette étude, une analyse bidimensionnelle, a été réalisée à l'aide du logiciel de dynamique des fluides numérique (CFD) ANSYS Fluent afin de simuler l'écoulement du fluide à travers dans le lit catalytique du propulseur à monergol system pour les applications spatiales. Le fluide utilisé est le peroxyde d'hydrogène (H2O2) comme propergol vert, à une concentration de $87,5\%$ avec un lit catalytique constitué de particules d'argent sphériques identiques. La méthode des volumes finis a été utilisée pour résoudre l'équation gouvernante. Une approche mathématique basée sur le modèle de non-équilibre thermique local (LTNE) a été utilisée pour décrire le transfert de chaleur à travers les phases solides et fluides. La simulation a permis d'optimiser les performances du lit catalytique pour une décomposition optimale du peroxyde d'hydrogène et de générer la poussée requise de 20N.

Mots-clés

Peroxyde d'hydrogène - Propergol vert - Lit catalytique - Propulseur à monergol.

Paper ID : 26

Enhancing PV System Grid Integration through a Dual-Stage Configuration and Model Predictive Control of a PUC5 Inverter

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Abstract

This paper presents a dual-stage, single-phase photovoltaic (PV) system connected to the grid through a fivelevel Packed U-Cell (PUC5) inverter, controlled by Model Predictive Control (MPC). The system is designed to optimize grid integration by delivering superior current injection with minimal Total Harmonic Distortion (THD), ensuring reactive power compensation, and maximizing the efficient extraction and injection of power from the PV source. The simulation findings validate the resilience and viability of the system by demonstrating how well the suggested control strategy improves power quality, responsiveness, and accuracy under a range of weather situations.

Keywords

multilevel inverter - PUC5 - dual-stage - MPC controller - MPPT - THD.

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Paper ID : 27

Advancements and Applications of Energy Harvesting Technologies in Wearable Devices: Feasibility, Integration, and Future Directions

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Abstract

The fast spread of wearable technology, spanning gadgets such as smartwatches and fitness trackers, has substantially altered personal health management and everyday convenience. Despite these developments, the need on external power sources—particularly batteries—poses considerable obstacles, including bulkiness, frequent recharging, and general discomfort. To alleviate these challenges, energy harvesting technologies provide a possible alternative by turning ambient energy into electrical power, therefore allowing wearables to function independently. This research critically assesses the feasibility and promise of merging three main energy harvesting technologies—piezoelectric, the rmoelectric, and photovoltaic— into wearable devices. Through an in-depth investigation of performance parameters such as power production, efficiency, durability, and environmental impact, the research reveals the most effective techniques for utilizing these technologies. The findings demonstrate that each energy harvesting technique provides distinct strengths and limits, but their combined usage may greatly boost device functioning and sustainability. The research suggests that adding energy harvesting into wearable technology not only increases user comfort and operational autonomy but also promotes the possible uses and environmental advantages of future wearable devices. functionality of wearable gadgets. By solving these hurdles, energy harvesting has the potential to alter the area of wearable technology, allowing creative applications and extending the possibilities for autonomous, self-powered devices.

Keywords

Energy Harvesting - Wearable Technology - Piezoelectric Devices - Thermoelectric Generators - Photovoltaic Cells.

Paper ID : 28

Shading Effect on Mono-Crystalline PV Module Performance Installed in Annaba, Algeria

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Abstract

This article presents an experimental study on the photovoltaic module installed in Annaba. We have described the importance of bypass diodes on the performance and efficiency of photovoltaic system, and their roles of protecting photovoltaic modules from hot spots causing the deterioration and destruction of PV module. A PV module model was proposed on the MATLAB/ Simulink environment, which precisely describes the Current-Voltage and PowerVoltage characteristics, of PV module under the climate of Annaba and the impact of partial shade. The obtained results were compared with practical databases, confirming the stability and performance of the proposed model.

Keywords

Mono-crystalline PV module - partial shading - Mtalb/Simulink model - PV module characteristic.

Paper ID : 29

Effect of Rectangular Fin Arrangement on the Melting Process of Nanoparticle-Enhanced Phase Change Materials

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Abstract

Phase change materials (PCMs) are essential components of thermal energy storage systems, with their thermal storage rate linked to the melting rate and heat distribution. The problem of slow heat transfer, particularly in the lower layers of PCM capsules, has been identified as a significant challenge. This research aims to improve the heat distribution and melting rate of nanoparticle-enhanced PCMs (NEPCMs) in octagonal-shaped shell capsules by incorporating dendrite-shaped fins. The research contribution is the investigation of three distinct fin configurations: random arrangement (case 1), downward decrease in fin length (case 2), and downward increase in fin length (case 3), along with varying nanoparticle volume fractions ($\phi = 0\%,\ 3\%,\ and\ 6\%$). The method used for simulating heat transfer during phase change is the porosity enthalpy method. The results indicate that integrating fins and increasing the nanoparticle concentration enhances the thermal conductivity of the PCM. Case 3, which involves downward increasing fin length, demonstrated the highest heat transfer rate and the shortest fusion time, reducing the melting rate by 15% compared to case 2. Furthermore, the study reveals that a nanoparticle concentration of $\phi = 6\%$ results in a 20% decrease in melting rate and the smallest decline in the average Bejan number. In conclusion, the use of dendritic fins and nanoparticle-enhanced PCMs significantly improves thermal performance, especially in the outer layers of the PCM capsules.

Keywords

NEPCM - Melting process - FEM - Heat transfer - Fin - Latent Heat Thermal Energy Storage.

Paper ID : 33

Design and Experimental Analysis of a Linear Fresnel Collector for Solar Desalination in Algeria

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Abstract

Solar desalination is a promising solution for addressing water scarcity in Algeria, using the country's enormous solar energy resources. Desalination technology may produce fresh water in a sustainable and environmentally friendly way by using solar energy. The present work discusses the design and experimental analysis of a linear Fresnel collector with a semi-cylindrical cavity to be employed in a single-stage flash (SSF) desalination plant. The purpose of this study is to investigate the viability and effectiveness of an LFC prototype constructed at Blida University. A simulation study using MATLAB was then carried out. The results revealed that a 5 m^2 solar array could produce 0.1 kg of distillate per day . The system has a specific thermal energy consumption (STEC) of 308.2 kJ/kg and a gain output ratio (GOR) of 0.7 kg of distilled water per kilogramme of steam.

Keywords

Linear Fresnel collector - SSF plant - solar desalination - freshwater.

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Paper ID : 34

DFIG-WECS Speed-Sensorless IGBT Open Circuit Fault Optimization Using Fuzzy Sliding Mode Observer

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Abstract

The work presented in this paper deals with Wind Energy Conversion System (WECS) speed-sensorless based on Fuzzy Sliding Mode Observer (FSMO) in Doubly Fed Induction Generator (DFIG) Rotor Side Converter (RSC) IGBT open circuit fault presence. First an indirect power control based on the proportional integral (PI) controller is used and considered as a reference well known approach, then DFIG-WECS speedsensorless using Sliding Mode Observer (SMO) is presented and implemented in the IGBT open circuit fault occurrence. In the aim of optimizing the DFIG-WECS electrical power generation in the fault presence, Fuzzy Sliding Mode Observer (FSMO) is used. The results obtained under MATLAB-Simulink gives value to the FSMO through the faulty condition.

Keywords

Fuzzy Sliding Mode Observer - IGBT open circuit fault - DFIG - WECS - PI controller - MPPT.

Paper ID : 39

Improving the Performance of a Hybrid Solar Panel PV/T Using a Solid Corrugated Strip Insert and Water/MWCNT Nanofluid in the Coolant Tubes

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Abstract

The hybrid PV/T (Photovoltaic Thermal) system is designed to provide electrical and thermal energy simultaneously. This dual operation reduces the temperature of the photovoltaic cell by extracting heat through the heat transfer fluid. In this way, the overall efficiency of the solar system is increased. This study aims to model a 3D PV/T system in steady state with the integration of a corrugated solid insert inside the tubes. The heat transfer fluid considered is based on the water/MWCNT couple, and the single-phase homogeneous model is used to model the nanofluid flow. To analyze the system performance, a dual energy and exergy analysis was performed. In this study the number of tubes that form the heat exchanger was varied $5 \leq N \leq 25$. The results showed that increasing the number of tubes improves both the thermal and electrical efficiencies with an insignificant penalty in pumping power. From an exergy point of view, an improvement in the quality of electrical energy is obtained at N=25, due to the reduction in the temperature of the photovoltaic cells.

Keywords

hybrid solar panel - corrugated strip - nanofluid - coolant tubes - exergy.

Paper ID : 40

Analysis of Low-Frequency Oscillation in Power System with Renewable Energy Sources

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Abstract

Power systems often experience low-frequency oscillations (LFOs) that, if left unchecked, can lead to instability over time. To mitigate these oscillations, Power System Stabilizers (PSS) are employed through excitation control. In this study, three metaheuristic algorithms—Particle Swarm Optimization (PSO), GOOSE-inspired Optimization Algorithm (GOOSE), and Zebra Optimization Algorithm (ZOA)—were applied for optimal tuning of the tilt-integral-derivation (TID) based PSS parameters in a renewable-integrated multi-machine power system. The results show that ZOA outperformed PSO and GOOSE in enhancing system stability under three phase symmetrical fault.

Keywords

Power system stabilizer - Tilted Integral Derivation Control - small signal stability - Metaheuristic Algorithms.

Paper ID : 41

Physical Properties of New Ternary Chalcogenide Copper Molybdate Sulfur I- Cu2MoS4

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Abstract

Ternary I-Cu2MX4 materials are of great interest because in recent years due their suitable optical and electrical properties and to their different technological application especially solar energy, photocatalysis. In the present work we using ab-initio technic, was carried out to study the structural, electronic properties of the ternary tetragonal I-Cu2MoS4 structure. Calculations have been carried out using the plane-wave pseudopotential approach within the framework of the density functional theory (DFT) as implemented in CASTEP code. The calculated structural parameters show a good agreement with the experimental results. The computed partial density of states diagrams, charges transfer and distribution of charge density show that the interatomic bonds are mainly of a covalent nature. Moreover, population analysis is used to check the nature of the chemical bonds. Our DFT calculation indicates that Cu2MoS4 compound is a semiconductor with indirect energy band gap of X-G type. In addition to the GGA-PBE, the band structure have been also treated within the nonlocal hybrid functional HSE06. The elastic and optical properties of I-Cu2MoS4 were predicted, for the first time, the elastic constants were calculated which exhibits the compounds are mechanically stable by satisfying the condition of stability. Frequency-dependent linear optical parameters are predicted in an energy window from 0 eV to 15 eV for incident electromagnetic radiation polarized parallel to the three principal crystalline directions.as our results show that the studied materials are brittle and are always transparent and shows rather good absorption coefficient in the ultraviolet region.

Keywords

ab initio calculations - Cu_2MoS_4 - semiconductor - structural - electronic properties.

Paper ID : 43

Cold Production Using Solar Energy

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Abstract

The numerical modeling and performance rediction of a solid adsorption solar refrigerator, using activated carbon BPL/ammonia adsorbent/adsorbate pair are presented. The mathematical model is based on the thermodynamics of the adsorption process, heat and mass transfers within the adsorbent/adsorbate pair in the refrigerating system.

Keywords

Modeling approach - Refrigeration - Solar energy.

Paper ID : 45

Computational Evaluation of Curved Tube Receiver Performance: Comparing Thermo-Hydraulic Impacts of Nanofluids and Conventional Fluids

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Abstract

A three-dimensional numerical analysis of heat transfer in a parabolic through collector's tube receiver, operating with and without nanofluids, was conducted. The study aims to enhance the thermo-hydraulic performance of the absorber tube by increasing fluid turbulence through a wavy internal surface and improving the convective heat transfer coefficient between the heat transfer fluid and the tube receiver wall. Two key factors influencing thermo-hydraulic performance were investigated: the type of working fluid and the internal surface profile of the tube receiver. To achieve this, three heat transfer fluids were examined: water, Therminol VP-1, and Al2O3-based thermal oil nanofluid. The simulations employed the RNG $k-\epsilon$ turbulence model, using the finite volume method with ANSYS software. Results indicate that the Nusselt number increased by 3 to 3.5 times for the wavy tube with 2% Al2O3-based thermal oil nanofluid compared to a smooth tube. Additionally, the use of nanofluid in a wavy tube enhanced the overall thermo-hydraulic performance by up to 11.19%. Other numerical results, such as pressure drop and temperature variations, were also analyzed and compared with existing empirical and experimental data.

Keywords

Tube receiver - Nanofluid - HTF - Nusselt number and thermo-hydraulic performance.

Paper ID : 48

Improved Super-Twisting Sliding Mode Control of twostage PV Grid-Connected Converter

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Abstract

The study introduces an Adaptive Super Twisting Sliding Mode (ASTC) technique to enhance the stability and robustness of dc-link voltage in a photovoltaic (PV) gridconnected system. The technique is designed to regulate dc-link voltage quickly and sustain minimal oscillations, ensuring stable operation under dynamic situations. The ASTC's effectiveness is particularly noteworthy in mitigating current total harmonic distortion (THD), which can negatively impact power quality and system efficiency. Comparing the ASTC to conventional control systems, such as Super Twisting and ProportionalIntegral controllers, was conducted using MATLAB/SIMULINK simulations, providing a comprehensive framework for evaluating performance measures across various operating situations.

Keywords

PV - Dc-Link regulator - Super twisting control - THD.

Paper ID : 49

Simulation d'un Système PV/Pile à Combustible avec Stockage pour une Ferme Laitière

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Résumé

Ce travail porte sur l'étude et la simulation d'un système multi-sources à énergies renouvelables avec stockage pour alimenter une ferme laitière située dans la commune d'IFERHOUNENE. Les systèmes multi-sources combinent plusieurs types de sources afin d'optimiser la production d'énergie. La conception d'une installation multi-sources nécessite une analyse des besoins énergétiques du site, la disponibilité des ressources renouvelables et l'intégration de technologies de stockage d'énergie. En utilisant le logiciel HOMER Pro, nous avons modélisé un système multi source en combinant les sources d'énergie disponibles. La simulation nous a permis d'identifier la configuration la plus efficace pour répondre aux besoins énergétiques de la ferme. Les simulations réalisées ont démontré la faisabilité technique du système proposé dans son ensemble. Enfin, cette approche vise à promouvoir un modèle agricole durable, réduire les coûts énergétiques et diminuer l'empreinte carbone de l'exploitation.

Mots-clés

Système multi-sources - Energies renouvelables - Ferme laitière - Stockage d'énergie - HOMER Pro.

Paper ID : 52

Thermogravimetric and Kinetic Analysis of Syagrus Romanzoffiana Fibers for Alternative Renewable Energy Systems

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Abstract

This study used thermogravimetric analysis to investigate the kinetics and thermodynamics of Syagrus Romanzoffiana fibers (SRFs). We heated SRFs non-isothermally between 25 and $800°C$in a nitrogen atmosphere at three different rates: $5°C/\text{min}$, $10°C/\text{min}$, and $15°C/\text{min}$. Thermogravimetric analysis revealed that SRFs pyrolyzed in three phases. The second stage's kinetic and thermodynamic properties have been determined. The low-temperature stable components were decomposed at temperatures ranging from 218 to $376°C$, 218 to $391°C$, and 218 to $394°C$ at heating rates of $5°C/\text{min}$, $10°C/\text{min}$, and $15°C/\text{min}$, respectively. The Coats-Redfern approach was used on twenty-one different kinetic models representing four major solid-phase reaction processes. The diffusion model using the Zhuravlev equation is the best-fitted model, with the highest correlation coefficients ($R2 > 0.99$) across all heating rates. Heating rates of 5, 10, 15, and $20°C/\text{min}$ produced activation energies of 114.02, 118.77, 119.44, and 113.89 kJ/mol, respectively. Thermodynamic properties ($\Delta H,\ \Delta G,\ and\ \Delta S$) were calculated using kinetic parameters. The data given here contributes to the evaluation of SRFs as a potential biomass renewable energy source for reactor construction and chemical production.

Keywords

Syagrus Romanzoffiana fibers - Thermogravimetric analysis (TGA) - Coats-Redfern method (CRM) - pyrolysis - kinetics - thermodynamics.

Paper ID : 54

Effectiveness in the Safety and Security of Energy Systems Case of Risk Management in Electricity Power Plant

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Abstract

This article discusses the efficiency of nuclear energy production systems. Significant efforts are being made in the field of nuclear safety and security, which is constantly evolving on a global scale, to promote a safe, scalable, and sustainable development environment aimed at enhancing the protection of people, materials, facilities, nuclear information, and the environment against the harmful effects of radioactivity on human health. Preventive and forward-looking measures must be taken to address potential threats to nuclear assets, such as accidents during operation, use, transportation, theft, sabotage, and the illegal trafficking of nuclear materials and radioactive sources. This article presents nuclear energy as a green energy, based on the efficiency of electronuclear systems and an assessment of the benefits and challenges that remain. Our presentation is based on a structured analysis, with the bibliography carefully selected for the relevance of the articles reviewed and classified according to the main topics identified to support our objective. The article aims to serve as a scientific resource for the choice of green energy, specifically nuclear energy, with a focus on electronuclear energy, while highlighting the central role of security and safety in protecting against nuclear threats and radiological risks in a world transitioning to nuclear energy.

Keywords

Green energy - nuclear energy - electronuclear energy systems - nuclear safety - nuclear security.

Paper ID : 55

A Genetic Algorithm for an Optimimum Design in Composite Laminate

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Abstract

Unlike the typical traditional hill-climbing techniques to design a composite laminate. A genetic algorithm code in MATLAB is proposed in this work to optimize of the geometric parameters of laminates panels, treating the following design variables: number of layer, fiber orientation angle and thickness of each layer. The optimization is based on Tsai-Wu criteria and the genetic operators are applied randomly. In order to get the best panels suiting and satifying the engineer needs. This paper presents the numerical study of the optimization of the geometric parameters of laminates panels , treating the following design variables: number of layer, fiber orientation angle and thickness of each layer. The optimization is based on Tsai-Wu criteria and the genetic operators are applied randomly. A program developed under MATLAB software in order to give the best optimized panel.

Keywords

Design - Genetic Algorithm - composite laminate - optimization - Tsai-Wu.

Paper ID : 56

Influence of the Convergent-Divergent Form of the Collector on the Flow Behavior inside A SCPP

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Abstract

This work investigates numerical simulation of the effect of the convergent-divergent form of the collector on the flow behaviour in a solar chimney power plant using commercial software Ansys Fluent. The study focuses on the convergent-divergent form of the collector for various positions along the collector $Rc*(3.125,\ 6.26\ and\ 9.375)$ and various height of the collector $Hc*(0.125,\ 0.25,\ 0.375\ and\ 1)$ at the convergence position. The momentum and energy equations are solved using finite volume method. A standard $K-\epsilon$ turbulent model is used. Results revealed that the convergent-divergent form of the collector affect sensitively the flow behaviour. We note improvement of mass flow rate by modification of the geometrical form of the collector.

Keywords

Solar chimney - geometrical parameters - CFD - $k-\epsilon$ model - natural convection.

Paper ID : 57

Lumped Parameter Thermal Network Model of Three Phase Induction Motor

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Abstract

This paper deals with a Lumped Parameter Thermal Network (LPTN) for the study of the steady-state and transient solution to the temperatures of the 2.2 kW threephase squirrel cage induction motor. In particular, the thermal model is analyzed by Matlab code software using the analogies existing between the thermal and the electric fields. The model has been verified by means of the experimental test bench, and the temperatures measured have been compared with the simulation results.

Keywords

Induction motor - Lumped parameter - thermal model - Temperature - convection - conduction.

Paper ID : 59

Finite Element Analysis of a Tubular Linear Generator for Wave Energy Conversion

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Abstract

In recent decades, the increasing issues of energy deficits and ecological pollution have emerged as significant global challenges. The exploration of innovative technologies for the capture of renewable energy, particularly through wave energy, is considered crucial for addressing these challenges. Among the various solutions, the wave energy converter is recognized as one of the most effective methods for harnessing wave energy. This article delves into the modeling and evaluation of a Wave Energy Harvesting system, which incorporates a tubular linear generator with permanent magnets (TLPMG). This generator operates by converting the kinetic energy generated from the oscillatory motion of sea waves. The developed model relies on the governing equations of the magnetic field, articulated in terms of magnetic vector potential and magnetic scalar potential and is solved using the finite element method. The integration of electromagnetic and mechanical equations is conducted sequentially following the hydrodynamic modeling of the system. The oscillations of the waves are conveyed to the device as vertical displacements. Key findings from this study include the displacement and velocity of the floating buoy, excitation forces, and the resulting electromotive force.

Keywords

Ocean Waves - 3D Finite Element Method - Tubular Linear Permanent Magnet Generators.

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Paper ID : 60

High Efficiency Photocatalytic Hydrogen Production over Ternary System PANI-Mno_2- Agbr: Physical, Electrochemical and Optical Properties Studies

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Abstract

The present work explores the enhancement of the hydrogen evolution reaction (HER) through photocatalysis using a novel ternary system, Polyaniline (PANI)-MnO2-AgBr. We successfully synthesized by chemical route, the ternary photocatalyst PANI-MnO2-AgBr with varying amounts of AgBr (25%, 50%, *and* 75%). We then investigated the morphology, physical, and electrochemical properties of PANI-MnO2@AgBr using X-ray diffraction and UV–visible spectroscopy. Semi conductivity was demonstrated through capacitance measurements, which revealed flat band potentials ($Efb = 0.90,\ 0.86,\ and\, 0.33\, VSCE$) and carrier concentrations ($1.681021, ND = 4.54\ 1017\, and\, 1.38\ 1018\, cm^3$) for PANI, MnO2, and AgBr, respectively. Regarding the hydrogen production, a comparative study between PANI-MnO2-AgBr 25% and other prepared photocatalyst was conducted. PANI-MnO2-AgBr 25% exhibited the highest hydrogen evolution reaction (HER) performance, achieving a quantum yield of 1.53% and a release rate of $159.51\mu mol/g\ min1$. Notably, the photocatalytic activity was fully recovered after three successive cycles, showing no signs of deactivation, which indicates the catalyst's excellent reusability across multiple cycles.

Keywords

Hydrogen evolution reaction (HER) - PANI - MnO_2 AgBr - Photocatalyst - Reusability - Energy production.

Paper ID : 62

Integration of Biomass Energy into the Essential Oil Extraction Process

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Abstract

Agro-industrial processes that utilizes aromatic and medicinal plants generates various kinds of residues like residual biomasses from distillation of aromatic plant and non-utilized parts of medicinal plant. These residual biomasses cannot be considered as waste as these can actually be recycled and converted into value added products. Nevertheless, the energy potential of this waste is interesting and their integration as energy inputs in industrial processes has considerable economic and environmental stakes. These wastes can be used as fuel for production of steam necessary for the extraction of essential oils (EO) by hydrodistillation (HD). In this study, hydrodistillation extraction process using biomass as an energy source (BEHD)was applied for the extraction of essential oil from a plant from the Mediterranean region. The results obtained in terms of yield and extraction time were compared with those obtained by the conventional method using electric heating. The antimicrobial activity of the EO was evaluated against four bacteria and one pathogenic yeast, using the disc-diffusion method and minimal inhibitory concentration (MIC), whereas, the antioxidant activity of the EO was evaluated using the DPPH test. The results obtained showed that the EO extracted by BEHD have faster kinetics and higher efficiency with similar yields: 1.03% and an extraction time of 30 min against 180 min for classic hydrodistillation. In addition, the oil extracted by BEHD has a better antioxidant activity and it is much more active than that isolated by HD.

Keywords

biomass - energy - essential oil - extraction - aromatic and medicinal plant.

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Paper ID : 63

Fractal Dimension as a Diagnostic Tool for Signal Analysis in Polluted High-Voltage Insulators

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Abstract

This study presents the implementation of a multi-resolution algorithm based on the box-counting method to calculate the fractal dimension (FD) of various electrical signals, including leakage current and electrical load, recorded from a high-voltage flat insulator model exposed to pollution. The algorithm was validated using fractal parametric signals with known theoretical fractal dimensions, particularly the Weierstrass function (WF), showing strong agreement with theoretical values and a relative error of less than 2%. After validation, the algorithm was applied to the leakage current and load signals to evaluate the effectiveness of FD in describing insulator performance and identifying the most diagnostic signal under uniform and non-uniform pollution conditions. Results indicated that for uniform pollution, the FD of the leakage current increases with pollution conductivity, rising quickly at low conductivities and stabilizing at higher levels. In non-uniform pollution, the FD also increased with width and conductivity, with the highest values observed when pollution was on the high-voltage side. The FD of the electric load signal remained mostly unaffected by uniform pollution but showed increases in discontinuous pollution, highlighting its potential as a diagnostic tool for assessing the surface condition of polluted insulators.

Keywords

Fractal - leakage current - box counting method - HV insulator model.

Paper ID : 65

Enhanced Secondary Control Design for Three Phase VSI-based Microgrids

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Abstract

Microgrids (MGs) have become increasingly important in recent years for integrating Distributed Generation (DG) sources, energy storage systems, and controllable loads into low- and medium-voltage networks. These systems, often powered by Renewable Energy Sources (RESs) like solar and wind, are managed using a hierarchical control structure. At the primary control level, the focus is on balancing power among multiple converters while keeping voltage and frequency stable. However, deviations in these parameters can still occur, requiring secondary control to correct and restore them to their nominal values. This paper introduces a secondary control method based on Double Enhanced Second Order Integrator Frequency Locked Loop (DESOGI-FLL), aimed at enhancing DC offset rejection and improving performance in MG systems. The proposed approach addresses gaps in parameter tuning and control design for greater system stability.

Keywords

Three-Phase Microgrid - Photovoltaic System - Secondary Control - Restoration - synchronization.

Paper ID : 66

Experimental Implementation of Fuzzy Logic Based Energy Management for Horizon PEM Fuel Cell/Ultra Capacitor System

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Abstract

This paper presents an experimental implementation of an energy management strategy for fuel cell vehicle based on fuzzy logic control (FLC) for a Horizon PEM fuel cell assisted with an ultra-capacitor (UC). The UC cells are MAXWELL technology. The FLC is an online technique to optimize the energy flows between different sources in aim to minimize fuel consumption and maintain the state of charge of storage sources. To respect the dynamics of the fuel cell, a filter is added to the output of the FLC. The sources are chosen to increase the system's energy autonomy using Ragon diagram. All controls are implemented using dSpace 1005 board and the results show the effectiveness of those controls by respecting the dynamic of the fuel cell and maintaining the constraints control on the desired limits.

Keywords

Energy management - ultra capacitor - battery - fuel cell - vehicle - fuzzy logic.

Paper ID : 67

Passivity-Based Control Approach for Electric Vehicle Optimization

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Abstract

This study presents a hybrid energy system designed to supply a Permanent Magnet Synchronous Machine (PMSM) through the integration of a fuel cell and a supercapacitor, functioning as the primary and secondary power sources, respectively. The fuel cell serves as the main energy provider, delivering a steady baseline power, while the supercapacitor is employed to manage rapid load variations and supply peak power demands. This configuration leverages the complementary properties of each source: the fuel cell offers high energy density for sustained operation, while the supercapacitor provides high power density and rapid response capabilities, ideal for handling transient loads. The system's energy management is facilitated by a power electronic converter, which regulates the power distribution between the fuel cell and supercapacitor based on real-time load requirements. A control strategy has been developed to optimize fuel cell operation within its efficient operating range, thereby reducing stress on the fuel cell and extending its lifespan. This control strategy prioritizes supercapacitor discharge during high-demand periods, effectively buffering the fuel cell from sudden load changes, which could otherwise degrade its performance and efficiency. Such a hybrid system is particularly suited for applications requiring both reliability and flexibility in power delivery, such as electric vehicles, renewable energy integration, and remote power systems. By combining fuel cell sustainability with supercapacitor agility, this system achieves improved energy efficiency, extended component lifespan, and enhanced dynamic performance under variable load conditions. The findings from this research contribute to the design of more resilient and efficient power systems in advanced electromechanical applications.

Keywords

Energy management - ultra capacitor - fuel cell - vehicle - IDA-PBC.

Paper ID : 68

Thermal Performance of Wavy Channel Heat Exchange

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Abstract

Scientific investigations on heat exchangers are mainly utilized to build and enhance new engineering systems with higher thermal efficiency. The most attractive approaches to accomplish this objective are passive methods using nanofluids, fins, porous media and wavy walls. The present study emphasizes heat transfer in a nanofluid laminar flow within a wavy canal partially occupied by porous material. The physical modeling relies on the two-dimensional laminar formulation of Darcy-Brinkman-Forchheimer (DBF) and the local thermal equilibrium model (LTE). Numerical solutions are acquired based finite volume using Ansys Fluent software method. Furthermore, the numerical results are validated with previous works. The simulations are achieved for AISI 304 porous medium and CuO-water nanofluid. The combined effects of porous layer thickness and Reynolds number on heat transfer and temperature contours are explored and illustrated. The simulation results demonstrate that a porous layer insert can enhance heat transfer in clear wavy channels. The findings hold potential implications for diverse applications, ranging from advanced cooling systems to energy-efficient industrial processes.

Keywords

porous medium - heat transfer - wavy wall - nanofluid - entropy generation.

Paper ID : 70

Assessing the Role of Solar Irradiance Parameters in WRF Simulations: Implications for Climate Modeling and Renewable Energy Applications

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Abstract

This study explores the pivotal role of solar irradiance parameters in the Weather Research and Forecasting (WRF) model, emphasizing their significance in climate modeling and renewable energy applications. By evaluating key parameters such as downward shortwave radiation flux (SWDOWN), Direct Normal Irradiance (DNI), and Global Horizontal Irradiance (GHI), this research provides insights into how these factors influence solar energy availability and atmospheric dynamics. The analysis highlights the intricate interactions between solar radiation, atmospheric conditions, and surface properties, including the effects of aerosol optical depth (AOD) and cloud cover on solar irradiance levels. The study further investigates the implications of accurate solar irradiance modeling for climate projections and energy resource assessments, underscoring the importance of precise parameterization in WRF simulations. Results demonstrate that improved understanding and representation of solar irradiance parameters can enhance the predictive capabilities of climate models, ultimately facilitating more effective planning and optimization of renewable energy strategies. This research contributes to the advancement of both meteorological forecasting and sustainable energy solutions by integrating solar irradiance assessments into WRF simulations.

Keywords

Paper ID : 71

Evaluating Power Control Techniques for DFIGWT: A Comparison of Direct, Fuzzy Direct, and Indirect Control Methods

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Abstract

This study evaluates three power control strategies for DFIG wind turbines (DFIG-WT), Indirect Power Control (IPC), Direct Power Control (DPC), and Fuzzy Direct Power Control (FDPC), with a focus on energy quality and response time. Using Simulink MATLAB for simulation, the study compares each strategy's performance in maintaining high-quality energy output and its response time to fluctuations. IPC is effective in decoupling power control, offering stable energy quality with slightly longer response times. DPC is highlighted for its simplicity and rapid response but may compromise on energy quality under dynamic conditions. FDPC, utilizing fuzzy logic, demonstrates superior handling of uncertainties, improving energy quality and maintaining reasonable response times. The results reveal distinct trade-offs among these strategies, providing valuable insights for selecting the optimal control approach based on desired energy quality and response time.

Keywords

Fuzzy Direct Power Control (FDPC) - Indirect Power Control (IPC) - DFIG wind turbines - Energy quality - Response time.

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Paper ID : 77

Enhancing Electric Power Quality of AWPS by Modified Bridgeless SEPIC PFC Converter

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Abstract

This paper introduces an efficient bridgeless power factor corrected (PFC) modified single-ended primary inductor converter (SEPIC) tailored for arc welding power supplies (AWPS). The proposed system features two key components. In grid side, a modified bridgeless SEPIC PFC converter, managed by a PI controller to ensure a high power factor and quick response, and in welding circuit side, a full bridge buck converter with a high-frequency transformer (HFT) to provide isolation, enhancing stability during welding. Simulations of the configuration and controllers are carried out across various operating conditions typical of AWPS. The system's performance is evaluated using power quality indicators, including power factor (PF), total harmonic distortion (THD) of the AC grid current, and voltage regulation. Findings indicate that the proposed design improves weld bead quality by delivering a steady output current and maintaining arc stability, aligning with international power quality standards and providing robust voltage regulation.

Keywords

Arc welding power supply (AWPS) - bridgeless PFC converter - modified single ended primary inductor converter (SEPIC) - PI controller.

Paper ID : 78

Performance Enhancement of DC-DC Boost Converter Using PSO-Optimized PI Controller

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Abstract

This paper presents an effective approach to enhancing the closed-loop control of boost converters using Proportional-Integral (PI) control optimized by Particle Swarm Optimization (PSO). Boost converters are crucial components in various power electronics applications, and their performance significantly depends on the efficacy of the control system. While PI controllers are widely used due to their simplicity and reliability, tuning them for optimal performance remains challenging. The PSO algorithm iteratively searches for the optimal combination of proportional and integral gains, aiming to minimize settling time, overshoot, and steady-state error while maximizing the overall system stability. The proposed method is validated through simulation experiments.

Keywords

Boost converter - PI - PSO - optimal tuning.

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Paper ID : 79

Application of Artificial Neural Networks for the Modeling of a Dual Fuel Diesel Engine Powered by Different Hydrogene Fractions

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Abstract

With dwindling oil reserves and environmental concerns about exhaust emissions from conventional diesel, attention is increasingly turning to alternative fuels such as hydrogen (H_2). Dual-fuel (DF) operation is an interesting technique both economically and environmentally. Artificial neural networks (ANNs) allow complex problems to be modeled and solved using structures inspired by the human brain, enabling artificial intelligence to perform tasks such as predicting outcomes. This paper presents the development of models using the ANN approach to predict both the effective efficiency (BTE), specific consumption (BSEC) and diesel energy of a DF diesel engine fuelled by different H_2 fractions. The input parameters of the models are effective power (BP) and H_2 (hydrogen), while engine efficiency (BTE), specific energy consumption (BSEC) and diesel energy are the output parameters. The data set showed maximum R values for the prediction of performance parameters (BTE, BSEC, Diesel Energy). The R values indicate that 99% of the total variation was identified and explained by the ANN model, and corresponds to the experimental data. These results highlight the reliability of the artificial neural network approach, offering high predictive capability, thanks to its speed and learning power.

Keywords

Dual fuel - Diesel engine - Prediction - Artificial neural network - Performance; Emissions.

Paper ID : 80

Prediction and Optimization of Performance Parameters and Emissions Characteristics of a Diesel Engine Fueled by Castor Oil-Based Biodiesel

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Abstract

In view of the declining oil reserves and the adverse environmental consequences of petroleum diesel exhaust, biodiesel has attracted attention as a renewable and environmentally friendly fuel. This work presents the development of models based on the artificial neural network (ANN) approach, for the prediction of performance parameters and emission characteristics of a diesel engine operating with a blend of biodiesel extracted from castor oil, as well as the optimization of the thermal efficiency of the engine using the genetic algorithm (GA). The engine load and the diesel and biodiesel blend ratio were considered as input parameters for the models, while the performance parameters which are effective thermal efficiency (BTE), specific energy consumption (BSEC), fuel mass flow rate (Fuel mass), exhaust gas temperature (EGT) and excess air ratio were considered as input parameters of the first model. The emission characteristics which are carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides (NOx) are the output parameters of the second model. The results showed a good correlation between the experimental values and the predicted values. The performance analysis showed that the accuracy of the models is very high. The dataset provided maximum linear correlation coefficient (R) values of 0.99838 for performance parameter prediction and 0.97584 for emission prediction. The integration of GA with ANN was able to optimize the best combination of diesel-biodiesel blend ratio and engine load for maximum effective thermal efficiency. These results reveal that the ANN-based approach is robust with high predictive power to predict the performance parameter and emission characteristics parameters of a diesel engine running on castor oil biodiesel blend, due to its combination of speed and learning ability.

Keywords

Genetic algorithm - Biodiesel - Diesel engine - Prediction - Artificial neural networks - Optimization.

Paper ID : 81

Simulation de la Dégradation de Performance Électrique d'un Module Photovoltaïque avec Fissuration

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Résumé

Les performances des modules photovoltaïques sous conditions réelles sont assez différentes que celles déterminées sous conditions de laboratoire pendant la qualification ou la certification. Cette différence est due au fait que les systèmes PV sont très sensible aux conditions climatologiques de site d'installation : rayonnement solaire, température, pression, humidité, vitesse du vent, pluviométrie, . . . , etc. En simulant ces phénomènes, on évalue leur effet sur les propriétés électriques du module, notamment la production de courant et la tension en fonction de l'irradiation solaire. Pour étudier l'influence de la fissuration sur une cellule PV, une analyse des performances électriques a été faite. La simulation de la dégradation de performance électrique d'un module photovoltaïque avec fissuration consiste à modéliser l'impact des fissures sur l'efficacité de conversion de l'énergie solaire en électricité. La simulation numérique sous MATLAB de la fissuration des cellules PV a permet d'estimer la dégradation des performances d'un module photovoltaïque et les résultats montrent que la dégradation du courant I_{cc} et de la puissance maximale P_{max} est linéaire. le courant de court- circuit I_{cc} chute de manière significative par rapport à la tension en circuit ouvert V_{co} et de même pour la puissance maximale P_{max} . Ainsi une altération de la surface par fissuration de 79% donne une perte de puissance de 24 à 25%.

Mots-clés

Système photovoltaïque - dégradation - modélisation - fissuration - performances électriques.

Paper ID : 82

Numerical Study of Thermal Efficiency Ventilated Cavity Using the LBM-MRT

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Abstract

This study delves into a numerical study of thermal comfort in the residential buildings using the Lattice Bolltzmann method (LBM). The research aims to enhance indoor air quality, ventilation efficiency and thermal comfort. The physical model considered consists of a rectangular cavity, characterized by an aspect ratio of two and ventilated by two diagonally opposite openings. The system of equations was solved using the Lattice Boltzmann method with multiple relaxation times (LBM-MRT). The extended Darcy Brinkman-Forchheimer model was used to simulate the porous material. The influence of different control parameters, including Rayleigh, Reynolds, and Darcy numbers, on flow dynamics, heat transfer and mass transfer was analyzed. The results reveal that the reactive porous partition significantly boosts thermal efficiency with peak performance achieved at specific permeability and partition heights. These findings offer essential insights for the design of advanced ventilation systems, ultimately contributing to improved indoor environmental quality.

Keywords

Thermal comfort - displacement ventilation - LBM-MRT.

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Paper ID : 83

Enhancing the Quality of Electrical Energy Generation in Wind Energy Conversion Systems Using Robust Sliding Mode Control

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Abstract

This paper investigates the improvement of the electrical energy production in wind energy conversion systems by applying a robust control strategy to a doubly fed induction generator (DFIG). This system presents significant control challenges due to its dynamic equations are highly non-linear, coupled, and complex. In this strategy, a sliding mode controller (SMC) is used in the vector control to avoid the drawbacks of using the proportional-integral (PI) compensator and improve the closed-loop control performance, such as steady state error, robustness against perturbations, and transient response. A simulation study is presented to demonstrate the performance of the proposed control scheme against the conventional vector control scheme that based on a PI compensator.

Keywords

Wind energy conversion systems - doubly fed induction generator - sliding mode controller (SMC) - vector control - proportional-integral (PI) compensator.

Paper ID : 84

Design and Implementation of a DC-DC boost converter for a Photovoltaic Water Pumping System

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Abstract

This work focuses on the design and implementation of a DC-DC boost converter for a Photovoltaic Water Pumping System (PVWPS). We propose an innovative DC-DC booster designed to enhance the overall efficiency of photovoltaic energy generation in standalone applications. The proposed booster distinguishes itself with reduced switching losses, attributed to the integration of the IR2110 driver, streamlined command simplicity, and minimized circuit congestion compared to existing solutions. This system is engineered to convert a 30V DC input from solar panels into a variable DC output, crucial for powering one of the water fountains at our faculty across varying water heads.

Keywords

DC-DC boost converter - PVWPS - Electronic Card Design - Solar panels.

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Paper ID : 85

Modeling Biohydrogen Production from Organic Wastes via Dark Fermentation using Artificial Neural Networks

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Abstract

The growing focus on sustainable energy has spurred interest in biohydrogen production through dark fermentation of organic waste. This approach offers the dual advantages of clean energy generation and effective waste management. However, optimizing the process remains challenging due to the complex interactions between substrate composition, microbial activity, and fermentation parameters. This study presents a modeling approach for biohydrogen production from organic wastes via dark fermentation using Artificial Neural Networks (ANN). Data from 10 published works were compiled to develop the model, with input variables including substrate type, temperature, pH, and substrate concentration, and biohydrogen yield as the output variable. The ANN model demonstrated high predictive performance, showing a strong correlation between predicted and experimental data, as evidenced by high R^2 value of 0.9977. This indicates the model's robustness and reliability in capturing the complex relationships governing biohydrogen production. By leveraging data from the literature, the study underscores the potential of ANN as a powerful tool for optimizing biohydrogen production processes, facilitating a deeper understanding of the key parameters influencing yield. This work provides valuable insights into the use of machine learning in renewable energy research and highlights the prospects of dark fermentation as a sustainable pathway for biohydrogen production.

Keywords

Artificial Neural Networks (ANN) - Biohydrogen - Dark fermentation - Organic wastes - Prediction.

Paper ID : 86

Effet de la Richesse sur des Flammes de Méthane Hydrogène

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Résumé

Cette étude présente les résultats de simulations numériques examinant l'influence de la richesse sur un mélange réactif composé d'air, de méthane (CH_4) et d'hydrogène (H_2), avec des concentrations de $50\% - 50\%$ pour le CH_4 et H_2. La richesse a été variée de 0.45 à 1 avec un pas de 0.5. Ces simulations ont été réalisées sur un brûleur haute pression, conçu pour une utilisation dans les turbines à gaz, opérant à une pression d'injection de 3 $bars$ délivrant ainsi une puissance avoisinant 120 kW. Les résultats de simulation révèlent des variations substantielles étroitement liées à l'augmentation de la richesse mélange réactif. Ces derniers revêtent une importance significative pour la compréhension des performances et de la stabilité de tels brûleurs dans des conditions de haute pression, avec des implications potentielles dans les domaines de la combustion industrielle et de la production énergétique par turbines à gaz fonctionnant avec $CH_4 - H_2$.

Mots-clés

Combustion - Pré-mélange - Hydrogène - Méthane - CFD - Ecoulement réactif - Turbulence - Polluants.

Paper ID : 87

Simulation Numérique de la Combustion du CH_4 Enrichi au H_2

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Résumé

La combustion flamme-less constitue un régime de combustion innovant du point de vue des émissions polluantes et de la consommation de combustible. Ce mode de combustion se caractérise fréquemment par des zones de réaction uniformément distribuées, susceptibles de réduire les gradients de température, les oscillations acoustiques et par conséquent, la génération de NO_x. La technologie de combustion sans flamme a démontré sa capacité d'adaptation à l'utilisation de combustibles conventionnels. Cependant, il s'avère nécessaire d'évaluer les performances des équipements thermiques industrielles lors de l'utilisation de combustibles alternatifs produits à partir de ressources renouvelables. L'hydrogène représente l'une des alternatives les plus prometteuses. Ce travail présente une étude numérique porte sur l'effet de l'utilisation d'un mélange $CH_4 - H_2$ comme combustible dans un brûleur à jet dans un écoulement coaxial chaud et de l'influence de la température d'entrée de l'air sur les émissions polluantes. L'étude a été menée pour 5 concentrations différentes de H_2 (de 5% à 30% avec un pas de 5%) et 7 températures d'entrée d'air (de 300 K à 900 K avec un pas de 100 K). Les résultats ont mis en évidence une diminution des NO_x et de CO en fonction de l'augmentation en teneur du H_2.

Mots-clés

Combustion - Pré-mélange - Hydrogène - Méthane - CFD - Ecoulement réactif - Turbulence - Polluants.

Paper ID : 88

Improving Power Quality and Dynamic Performance of Modular Multilevel Converter based Microgrid Solar System using Intelligent MPPT controller

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Abstract

while it provides perfectly clean electricity without any environmental effect, solar energy is the most abundant and free renewable energy source worldwide. However, because of its highly dependency on the weather condition variation particularly those of operating temperature and sunlight irradiance, the solar based electrical energy conversion system is characterized with lot of energy wastage and noticeable low efficiency, which requires an appropriate and effective design of its control part and components for enhancing its generation and delivery performance. The purpose in this work is to perform an investigate study and simulation under Matlab/Simulink environment of the behaviour and reaction of the artificial neural network (ANN) based MPPT controller under various and different climatic condition characterized particularly by the rate of the sunlight intensity variation during the day. Different weather situations regarding the sunlight intensity rate variation ranging from slow to harsh and severe changes are considered and applied in order to study the dynamic performance of the MPPT controller for improving the power quality generation as well as the dynamic performance of the grid tied solar conversion system when implemented around the modular multilevel converter as the newly power conversion emerged technology whatever these atmospheric situations. The simulation results have shown the superiority and outstanding of the ANN MPPT controller in terms of the output power quality and dynamic performance in reaching and retaining the stability at the higher power level regardless of the weather change.

Keywords

Microgrid solar system - Modular Multilevel Converter (MMC) - ANN - MPPT controller - Power quality - Dynamic performance.

Paper ID : 89

Prediction of Engine Performance for an Hydrogen Dual Fueled Diesel Engine using Artificial Neural Network

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Abstract

The present study investigates the use of Artificial Neural Network (ANN) modeling for prediction of performance characteristics of natural gas/diesel engine enriched with Hydrogen in dual fuel mode. ANN model was developed with two input parameters, load and hydrogen flow rate to predict the performance characteristics represented by the brake thermal efficiency (BTE) and the brake specific fuel consumption (BSFC). The trained ANN models were evaluated for various transfer functions by varying the number of neurons in the hidden layers. Logarithmic sigmoid and hyperbolic tangent sigmoid transfer function for Levenberg-Marquardt was found to be having best regression value. The overall regression coefficient (R^2), MSE and MAPE for the model developed are 0.99360, 0.0011 and 4.863001% respectively.

Keywords

Alternative fuels - Hydrogen - Performance - Artificial neural network.

Paper ID : 90

Optimization of Heat Exchanges in Forced Convection at the Level of a Fin Exchanger

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Abstract

The heat exchanges, in forced convection, of a condenser forming part of an air conditioner, in vertical position were numerically modeled by a program written under Matlab software. The simulation and the processing of the exchanges are carried out by optimizing the exchange coefficient as well as the power exchanged per linear meter of condenser. The results obtained allow an optimal dimensioning of the systems that can be used in different operating conditions.

Keywords

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Advanced Photovoltaic Pumping System Modelling and MPPT Control via Bond Graph

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Abstract

This study focuses on utilizing solar energy to generate electricity for powering a water pump via electric motors, highlighting the principle of photovoltaic pumping. Initially, we explain the photovoltaic effect and describe the various components of a photovoltaic system. We then model our solar pumping system, which includes a photovoltaic generator, a DC motor, and a DC/DC converter, using the bond graph method, a modern approach for modelling multidisciplinary systems. Following this, we examine several MPPT control methods, such as perturb and observe control, hill climbing control, and incremental conductance control. Ultimately, we propose a novel MPPT control based on bond graph principles and characteristic laws that influence the current and voltage at the output of the photovoltaic generator, allowing for control of the chopper without utilizing the duty cycle (α).

Keywords

MPPT - Photovoltaics - Pumping - Bond Graph - DC motor - DC/DC converter