Université Batna 1

Faculté des Sciences de la Matière

Département de Physique

Laboratoire de Physique Energétique Appliquée (LPEA)

Séminaire National sur l'Énergétique et les Énergies Renouvelables

22 avril 2024, Batna

Recueil Des Résumés

SNEER-2024

https://seminaires.univ-batna.dz/sneer24/

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Rendez-vous en SNEER-2025

Préambule

L'objectif principal de cette conférence est de créer un espace de rencontre et de discussion pour les universitaires et les chercheurs travaillant sur diverses thématiques liées à l'énergétique et aux énergies renouvelables. L'événement vise à favoriser la collaboration et l'échange d'idées autour des nouvelles avancées scientifiques et des innovations technologiques dans ces domaines cruciaux.

Au cours de cette conférence, les participants auront l'occasion de présenter leurs travaux de recherche, leurs découvertes et leurs travaux en cours. Ils pourront également discuter les défis actuels et futurs dans le domaine de l'énergétique, notamment en ce qui concerne la transition vers des sources d'énergie plus durables, propres et respectueuses de l'environnement. Les échanges d'informations et d'expériences entre les chercheurs provenant de différentes disciplines contribueront à enrichir la compréhension collective des problèmes liés à l'énergie et à stimuler l'innovation dans ce secteur.

Thématiques

A : Énergie Renouvelable

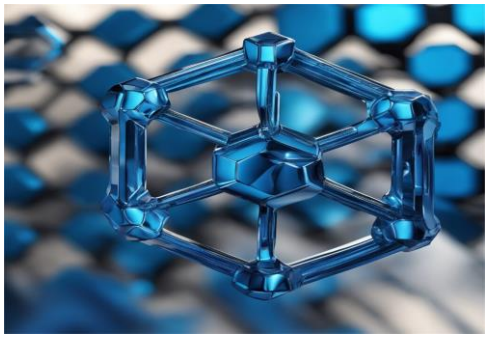
- *Énergies Solaire, Éolienne, Hydraulique, Géothermique*
- *Biomasse et Biogaz Stockage de l'Énergie Renouvelable*
- *Économie et Politiques des Énergies Renouvelables*
- *Innovations Technologiques et Recherche*
- *Transition Énergétique : Défis et Solutions*

B : Écoulement & Transfert thermique

- *Dynamique et écoulement des fluides*
- *Machines Thermiques*
- *Transferts de chaleur et de masse*
- *Échangeurs de chaleur*
- *Thermique du bâtiment*

C : Nano-fluides

- *Transfert thermique dans les Nano-fluides*
- *Caractérisation, modélisation et simulation des Nano-fluides*
- *Applications industrielles et médicales des Nano-fluides*



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Pr. Hamada HABA : Doyen de la Faculté des sciences de la matière

Président du séminaire

Pr. Azeddine SOUDANI : Directeur du laboratoire de physique énergétique appliquée

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Bouhantala Bigued	Univ. Batna 1
Aggoune Ayoub	Univ.Ouargla

Programme du séminaire SNEER2024

Lundi 22 avril 2024

- *Enregistrement*

08h :00 – 09h :00 — *Auditorium de l'université*

- *Cérémonie d'ouverture*

09h :00 – 09h :30 — *Auditorium de l'université*

- *1ère Conférence plénière*

09h :30 – 10h :45 — *Auditorium de l'université*

L'urgence climatique, la neutralité carbone et les perspectives du modèle énergétique algérien

Professeur émérite Chems Eddine CHITOUR

Ex-Ministre de la Transition énergétique et des Énergies renouvelables

Ex-Ministre de l'Enseignement supérieur et de la Recherche scientifique

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- *Pause-café*

10h :45 – 11h :00 — *Auditorium de l'université*

- *2ème Conférence plénière*

11h :00 – 12h :00 — *Salle des soutenances de la faculté des Sciences de la Matière*

Utilisation des Nano-fluides pour l'amélioration des transferts thermiques

Professeur Saadi BOUGOUL

- *Déjeuner*

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Communications orales/ Session 1

13h :30 – 15h :15 *Salle des soutenances de la faculté des Sciences de la Matière.*

Président : Pr Siham DJOUIMAA / Pr Mouna Maache

Temps	*Titre*	*Auteurs*
13h :30 – 13h :45	**Numerical simulation of natural convection heat transfer of nanofluid in an inclined cavity using lattice Boltzmann method**	**Chelia Walid**, L. Abdelghani, M. El hacene
13h :45– 14h :00	**Numerical investigation of the effect of a magnetic field and magnetic nanofluid on heat transfer enhancement in microchannels with different nozzle structures**	**Imene RAHMOUNE**, Saadi BOUGOUL
14h :00 – 14h :15	**A Comparative Study of Thermo hydraulic Behavior of Fe_3O_4-Ag and Fe_3O_4-Al_2O_3 Nanoparticles Suspended in Water/EG Mixture**	**Zeroual Hamza**, Benkhedda Mohamed
14h :15 – 14h :30	**Hybrid RANS/LES simulations of hydrogen turbulent premixed flame past a bluff body**	**Abdelkader Hemaizia**, A. Bentebbiche
14h :30 – 14h :45	**A Numerical Analysis of Porosity's Effect on Thermal Performance of Parabolic Trough Collector Receiver Tube**	**Diafi Halla**, S. Djouimaa, D. Guerraiche
14h :45 – 15h :00	**Analysis of Magneto-Hydrothermal Characteristics in a Horizontal Concentric Annulus with a Ternary Hybrid Nanofluid: A Numerical Study**	**Nihal Necib**, M. Benkhedda
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14h :00 – 15h :15 *Salle de bibliothèque de la faculté des Sciences de la Matière.*

Président : Pr Zeroual AOUACHRIA / Pr MAAMERI

Temps	Titre	Auteurs
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13h :45– 14h :00	**Numerical Simulation of Different Tandem Darrieus Wind Turbine Configurations**	**Mahdi GOUCEM,** O. IMINE
14h :00 – 14h :15	**Parameter optimization of building brick integration phase change material based on the energy consumption characteristics under hot climate.**	**Bachir Allam**
14h :15 – 14h :30	**Valorization of Hot pepper wastes from local industry in a fluidized bed reactor**	**Bellal Mohamed Nazim ,**Saouli Ouacil
14h :30 – 14h :45	**Dynamic Modelling of an innovative Air Conditioner**	**Merzaka Dahmani ,** Fouad Khaldi, Stitou Driss, Hamza Semmari
14h :45 – 15h :00	**Aerodynamic performance improvement of a wind turbine airfoil using passive flow control technique**	**A. Boudis,** D. Hamane, A. Bekhti, M. Tata, M. Debbache, O. Guerri
15h :00 – 15h :15	**Étude du comportement thermohydrique d'un bâtiment dans différentes zones climatique en Algérie**	**Fezzioui Naima**, Miloudi Yassine, Benyamine Mébirika

Pause-café / Session poster

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Communications orales/ Session 2

13h :30 – 15h :15 *Salle des soutenances de la faculté des Sciences de la Matière.*

Président : *Pr Abdelhakim BENMACHICHE / Dr Noui Samira*

Temps	Titre	Auteurs
15h :45 – 16h :00	تَوْصيفْ تَجْريبي لِبَديل السُّكَّر الطَّبيعي)الإريثريتول(لِاسْتَخْدامِهِ كَمَادَّة مُتَغَيِّرة اَلطور لِتَخْزين الحرارة في مِطْبَخَة شَمْسِيَّة	مروان زدايرية، أرزقي حرميم، عبد الكريم حيدة، عمار أمحمد، سمير مهاجر، محفوظ قاجة
16h :00– 16h :15	**Investigation on Combustion Characteristics and Emissions of Biogas mixtures with different oxidizers in Gas Turbine Combustion**	**Sabrina Benaissa,** Syed Mughees Ali, Z. Aouachria
16h :15 – 16h :30	**Numerical evaluation of propane/syngas flame CO/CO_2 emissions in preheated air combustion and oxygen-enhanced combustion**	**Bigeud Bouhentala,** A. Hadef, Aouachria Z., A. Mameri
16h :45 – 17h :00	**Gestion des déchets et évaluation des émissions de biogaz dans le CET de Batna : Analyse et perspectives**	**Assia Benkherrour**, B. Adouane
17h :00 – 17h :15	**Numerical Investigation Of Nox Emissions In Syngas-Ammonia Diffusion Flames Under MILD Combustion Regime**	**Benbouaziz Oussama,** Mameri A., Aouchria Z.

14h :00 – 15h :15 *Salle de bibliothèque de la faculté des Sciences de la Matière.*

Président : Pr Bouras Fethi / Dr Guaraiche Djamaa

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16h :00– 16h :15	**Estimation du rayonnement solaire global incident sur un plan horizontal à l'aide de divers modèles mathématiques**	**R. Khezzar** , M. Zereg
16h :15 – 16h :30	**Enhancing the efficiency of flat plat solar thermal collectors through computational simulations**	**Rihab Hamza**, F. Z. Ferahta, Dahmani M.
16h :45 – 17h :00	**A theoretical study on KGeCl3 for perovskite solar cells**	**Mohammed ElSaid SARHANI ,** M. L. Belkhir , T. Dahame, A. Begagra
17h :00 – 17h :15	**Optimizing Photovoltaic Systems: Unveiling Dynamics in SP and TCT Configurations Under partial shading conditions and mismatch faults**	**Lahlou ABAD,** S. TAMALOUZT, K. DJERMOUNI

- *Cérémonie de Clôture*

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Liste des résumés

Résumés

Calcul du bilan thermique et contribution à l'optimisation de l'atelier de cuisson de la cimenterie

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Résumé

La cuisson du clinker est l'étape intermédiaire des trois étapes importantes du processus de fabrication du ciment, qui sont : la préparation des matières premières ; la cuisson du clinker ; le broyage du clinker.

Dans une approche systématique, on dira que la fonction de l'atelier de cuisson consiste à transformer par traitement thermique, un matériau «cru» en un semi-produit désigné sous le nom de clinker. La préparation du «cru» consiste à mélanger et broyer les matières premières de manière à obtenir un produit ayant une composition et une finesse prédéfinies. Toute la problématique de la cuisson du clinker consiste à rechercher l'économie optimale de moyens, aussi bien en ce qui concerne le coût d'investissement que le coût d'exploitation.

Dans cette étude, nous nous sommes intéressés, dans la première partie, à établir le bilan thermique de l'atelier de cuisson de la cimenterie de Sour El Ghozlane afin de déceler toutes les pertes de chaleur anormales et de porter les améliorations nécessaires à son bon fonctionnement et aussi nous avons fait une étude technico-économique pour produire le clinker avec un meilleur coût possible en diminuant les pertes de chaleur pour faire fonctionner le four dans les conditions optimales.
Pour faire fonctionner correctement le four avec un débit acceptable et un clinker de bonne qualité avec une consommation calorifique optimale. Il faut avoir :
Un bon échange de chaleur entre le gaz et la matière, ceci se traduit par une bonne évacuation des fumées et un dépoussiérage à une température basse et avec un excès d'air optimal.
Une économie de chaleur du refroidisseur de clinker.
La majorité de l'énergie est consommée dans la zone de décarbonatation. Pour diminuer la consommation d'énergie, il faut diminuer la longueur de la zone de cuisson.

Les pertes de chaleur principales d'un four sont par radiation et convection à partir de surfaces extérieures du four. On peut réduire ces pertes en améliorant l'isolation des surfaces extérieures et en s'assurant que les portes du four sont toujours fermées et étanches.

Il faut recycler et réutiliser la chaleur des fumées dans le broyeur pour sécher la matière et pour diminuer la quantité de poussière qui sort avec les fumées donc contribuer à la protection de l'environnement.

Mot clés : clinker ;bilan thermique ; Les pertes de chaleur .

Effects of Electromagnetic Paramaters in Magneto-Hydro-Dynamic Micromixer

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Abstract:

In recent years, microfluidic devices have become more popular in a number sectors, including biotechnology, environmental technology, chemistry, and biomedicine. In many applications, there is a constant need to pump fluids from one part of the device to another. Adequate fluid mixing is also required in the interim. When the microchannel's characteristic length is relatively short, it is necessary to increase the mixing time with low diffusivity. Therefore, a more useful microdevice needs to be created in order to speed up the mixing process. An effective pumping and mixing technique is magnetohydrodynamics (MHD). In this work, the mixing parameters of two different electrolyte solutions are analyzed numerically and a novel magnetohydrodynamic micro-mixer is proposed. The Comsol multiphysics code is used to investigate fluid velocity and other flow properties in depth.

Keywords: Flow rate, Lorentz force; Magneto-hydrodynamic (MHD), Micropumps, Micromixer; Mixing performance;

Modelling and Simulation of a Double Stator Induction Machine for wind energy system conversion

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Abstract

In recent years and with the progress of science and technology, the global energy consumption continues to grow, the conventional sources of energy are limited and a number of problems are associated with their use such as environmental pollution. It is of great importance to develop clean and renewable energy to replace these traditional energy sources. Among renewable energy resources, wind energy is considered as one of the most promising and important sources of renewable energy in the world, mainly because it is clean, cost-effective, renewable, and harmless to the environment and also for its contribution to the reduction of CO_2 emissions. This paper presents the modelling and simulation of a dual stator induction machine under different wind conditions. This type of machine is one of the emerging electric multiport machines which have many advantages, such as power segmentation, high reliability and fault tolerance. The use of the induction generator with two stator windings in wind energy production system has the same advantages with the use of the doubly fed induction generator and the absence of slip ring and brush in the first type of generator increases their reliability. In this paper, after the description of the twin stator induction generator, we will proceed to establish its mathematical model. We will then develop a simulation program in Matlab/Simulink environment. The simulation results obtained under load change conditions describing the three modes of this machine (no-load, generator and motor) will be presented and discussed.

Keywords: Double stator induction machine, modelling, simulation, wind energy.

Graphical abstract

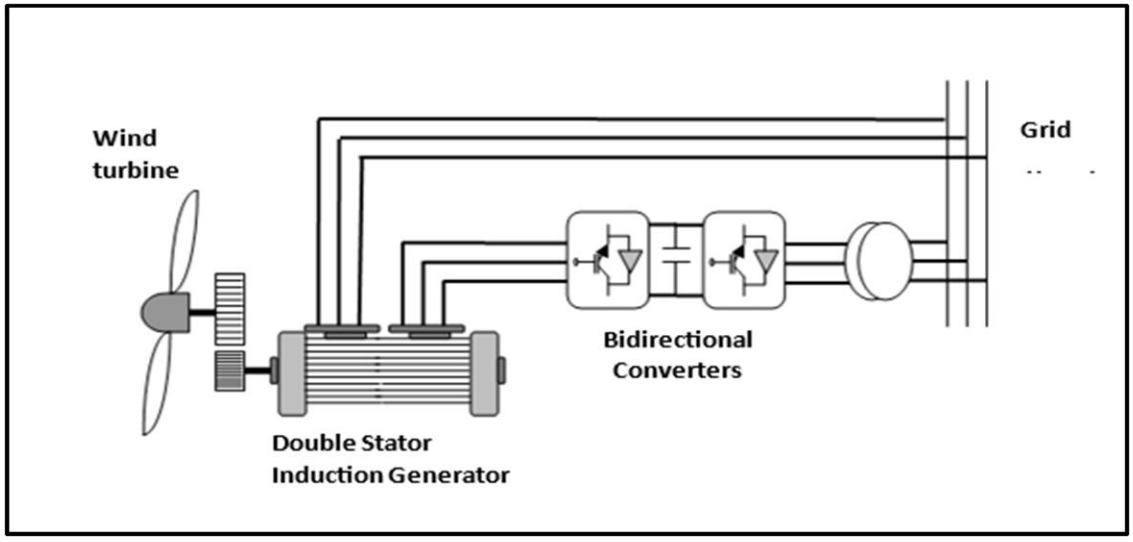

Fig.1. Wind energy conversion system based on a Double Stator Induction Generator

Effect of compression ratio on the performance, combustion of Hydrogen engine

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Abstract:

The present work investigates the influence of compression ratio on the performance, combustion of a single cylinder four stroke direct injections naturally aspirated Hydrogen engine. This study employs Open Modelica programming to investigate the intricate relationship between compression ratio16:1, 18.5:1 and 20:1, rate of heat release (ROHR), pressure dynamics, and brake thermal efficiency (BTE) in hydrogen internal combustion engines. The compression ratio, representing the ratio of maximum to minimum volumes in the combustion chamber, plays a pivotal role in shaping the engine's thermodynamic behavior.Our findings reveal a nuanced interplay of factors. As the compression ratio increases, the ROHR experiences a notable decrease due to the adiabatic nature of the compression process and hydrogen's unique thermodynamic properties. Simultaneously, there is a substantial rise in combustion chamber pressure, facilitating more efficient combustion during the power stroke.Surprisingly, despite the advantages in pressure and combustion efficiency, an increase in compression ratio correlates with a decrease in brake thermal efficiency. This decline is attributed to heightened heat losses, including increased heat transfer to engine components and elevated exhaust gas temperatures. The augmentation of pumping work during the compression stroke further contributes to this efficiency reduction.

Keywords: Compression ratio, Hydrogen engine, Open Modelica, Combustion.

Graphical summary

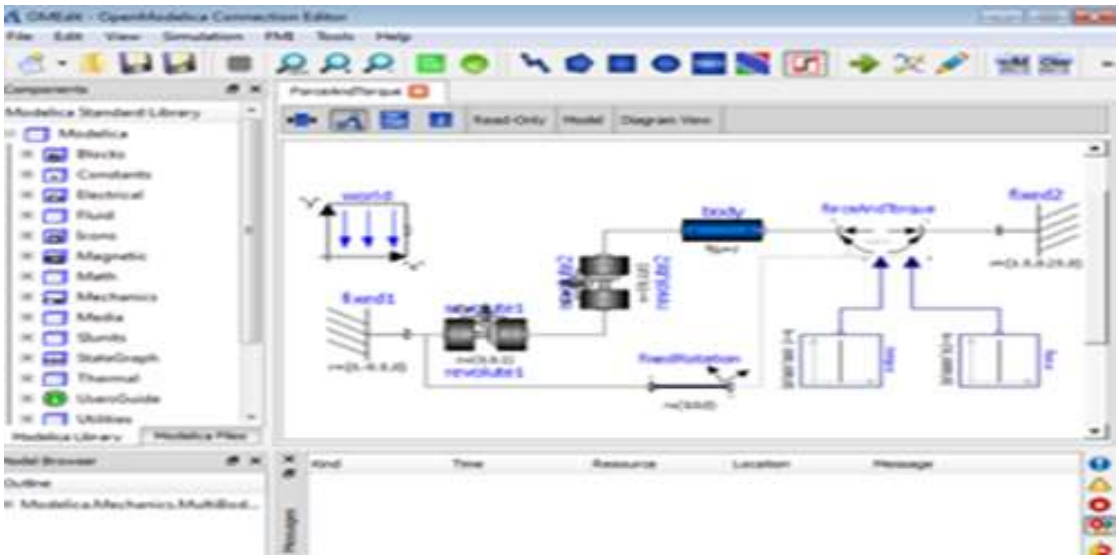

Fig.1. the program Open Modelica used in this study

La modélisation et la simulation d'un système hybride

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Résumé :

En raison de la demande croissante en électricité et de l'intérêt croissant pour les questions environnementales, l'utilisation de sources d'énergie renouvelables a été largement adoptée pour la production d'électricité, ainsi que pour atténuer l'impact de la pollution environnementale. Ces sources se distinguent par plusieurs avantages tels que la propreté, le coût bas et l'abondance.

C'est pourquoi, dans le cadre de notre recherche, nous avons suggéré l'utilisation de systèmes d'énergie renouvelable hybrides afin de surmonter les variations et l'instabilité associées à une seule source d'énergie renouvelable. En effet, cette approche permet généralement de réduire la complexité du système, d'éviter les interruptions de certaines sources d'énergie, et de minimiser les coûts en capital, contribuant ainsi à améliorer la fiabilité du système.

Le sud algérien et plus particulièrement le site de Béchar dispose d'un fort potentiel énergétique solaire et éolien ce qui plaide en faveur du développement des systèmes à sources d'énergies renouvelables dans ces régions. Il est alors nécessaire de connaître la contribution de chaque source (photovoltaïque et éolienne) pour l'alimentation de la charge afin de faire ressortir la variante optimale, tenant compte du facteur économique.

Les principales sources d'énergie utilisées dans notre travail sont les technologies d'énergie renouvelable, en particulier l'éolien le photovoltaïque et la biomasse.

Nos objectif est de trouver la meilleure configuration possible entre le générateur photovoltaïque, l'éolienne, le générateur de biomasse et la capacité de stockage des batteries afin de satisfaire les besoins en énergie de la charge avec un cout économique le plus réduit.

Donc, nous commencerons initialement par modéliser chaque source d'énergie du système participant à l'approvisionnement en énergie, puis nous les simulerons à l'aide de MATLAB pour vérifier la fiabilité du système dans la région désertique de Béchar.

Mot clé : énergies renouvelables- système hybride-le stockage-optimale.

تَوْصيفْ تَجْريبي لِبَديل السُّكَّر الطَّبِيعيّ (الإريثريتول) لِاسْتخْدامِهِ كَمَادَّة مُتَغَيّرة اَلطّورِ لِتَخْزين الحرارة في مِطْبَخَة شَمْسِيَّة

مروان زدايرية[1,2]، أرزقي حرميم[1]، عبد الكريم حيدة[1]، عمار أمحمد[1]، سمير مهاجر[1]، محفوظ قاجة[2]

1 وحدة البحث في الطاقات المتجددة في الوسط الصحراوي - مركز تنمية الطاقات المتجددة- أدرار، الجزائر

2 مخبر الطاقة التطبيقية والتلوث- قسم الهندسة الميكانيكية- كلية العلوم والتكنولوجيا- جامعة قسنطينة1- قسنطينة، الجزائر

Experimental characterization of a natural sugar alternative (Erythritol) for use as a phase change material in a solar cooker with heat storage

ملخص البحث:

تُسْتخدم المواد المتغير الطَّور(Phase Change Material (PCM) كوسيلة فعّالة لتخزين الطّاقة الحراريّة في المِطْبَخَاتْ الشّمسية لتحسين أدائها عند مرور السّحاب وبعد غُروب الشمس. لِاختيار المادّة المناسبة لِتصميم وحدة تخزين الحرارة المطلوبة يَسْتَلْزم مَعْرفة الخَصائص التِّرْموفيزيائيَّة للمَادَّة. ويتم تَحْديد الخصائص التّرموفيزيائيّة (التّوصيف الحراري Thermal Characterization) للموادِّ المتغيّرة اَلطَّورِ عمومًا وفق إجراء تجريبي يتم إجراؤه في مخابر مُتَخصصة وباسْتخْدام أجهزة باهظة الثَّمن (المِسْعَر الحَراريّ Differential Scanning Calorimetry DSC). في هذه المقالة نُقَدم توصيفًا تجريبيًّا لِبَديل السُكَّر الطَّبيعي (الإريثريتول) الذي تمَّ اقتناؤه قَصد اِستخْدامه كمَادَّة مُتَغيرة اَلطّور لِتخْزين الحرارة في مِطْبَخَة شَمسِيَّة تمَّ تَطْويرها بِوحدة البحْث في الطَّاقات المتجدِّدة في الوسط الصحراوي في أدرار. تمَّ قِيَاس التَّغَيُّر في المُحْتوى الحَراري كَدَالَّة لِدرجة الحرارة بِاسْتخْدام طَريقَة تَاريخ درجة الحرارة (T-history method)، والتِي تَسمَح بِتحْديد الخصائص التِّرْموفيزيائيَّة لِلْمواد المتغيّرةِ اَلطَورِ. لِهذا الغرض تمَّ إنشَاء مِنَصة اِختِبار بِاسْتعْمال الوسائل المتوفِّرة محلِّيًا في مَخْبَر قِسم التَّحويلات الحرارية بِالوحْدة البحْث في الطاقات المتجدِّدة في الوسط الصَّحراويّ بأَدرار حَيْث أُجْريَّت التَّجارب وفْق بُروتوكول تَجْريبيّ بَسيط بِاسْتخْدام كبْسولات نُحَاسية أُسْطوانيَّة لِعيّنات الإريثريتول وزَيْت (TORADA TC46) كَمَادَّة مَرجعِية، بِالْإضافة إلى فُرْن المَخْبر (Memmert INE 300). أَدَّت مُعَالجَة البَيانَات التَّجْريبيَّة إلى الحُصول على خَصَائِص التِّرْموفيزيائيَّة تَتَوافَق معَ تِلك الخاصَّة بالاريتريتول الصَّافي والمَوْجودة بِالمراجع المتخصِّصة حَيْث بَلَغت حَرارَة الإنْصِهار الكامنة 341 kJ/kg ودرجَة حَرارَة الإنْصهار 118°C مِمَّا يُثْبِت مُلَاءمَة بديل السُكَّر الطَّبيعي (الإريثريتول) لِاسْتعْماله كَمَادَّة مُتَغيرَةِ الطَّور لِتَخْزين الحرارة في المِطْبَخة الشَّمْسيَّة.

Valorization of expired pharmaceutical waste as environmentally friendly corrosion inhibitor for steel in hydrochloric acid medium

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Abstract

Energy transition and waste management are crucial to promoting sustainable practices. Reducing greenhouse gas emissions is a key objective in this context. To avoid incinerating expired medicines, using them as corrosion inhibitors offers an environmentally-friendly solution. This approach makes a concrete contribution to reducing CO_2 emissions, in line with responsible resource management and the promotion of ecological practices. The thermodynamic study of kinetic parameters and adsorption modes offers valuable perspectives for the development of more effective and environmentally friendly corrosion inhibition strategies, and is essential for understanding inhibitor adsorption phenomena, behavior and effectiveness in preventing steel corrosion in 1M hydrochloric acid (HCl) solution. The adsorption mode, temperature effect, Arrhenius lines, as well as parameters such as activation energy (Ea), activation enthalpy (ΔH*a) and activation entropy (ΔS*a) were studied, in the concentration range of 15 to 44 (10^{-6} mol/L). According to the results, the drug acts as a type inhibitor following the Langmuir isotherm. This is confirmed by the slight effect of the process with increasing temperature. The values of Ea demonstrate the formation of a protective film on the steel surface, and the values (ΔH*a) and (ΔS*a) indicate that the phenomenon is attributed to ordered endothermic adsorption. The results obtained confirm the consistency of the methods employed. These data underline the drug's effectiveness as a corrosion inhibitor, offering promising prospects for environmentally-friendly applications in line with energy sustainability objectives.

Keywords: Pharmaceutical waste, CO_2, Corrosion inhibition, Steel, Kinetic parameters.

Design and Implementation of a low-cost Solar Tracker based on Arduino board

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Abstract :

The use of solar energy is essential to meet growing energy demand and reduce carbon emissions. Solar energy is one of the most crucial renewable energy sources. However, we face several challenges in maximizing its potential, including reduced efficiency and energy loss, as fixed solar panels are limited in their ability to adapt to changes in the sun's position throughout the day and the year. This results in a reduction in energy capture and overall efficiency. Resulting in increased costs that may hinder its full potential as a clean, sustainable energy source. To optimize energy capture from solar panels, solar tracking systems are essential. In this paper, we present a complete design and implementation of a low-cost solar tracker based on Arduino platform technology. The tracker uses light sensors, including photoresistors, to detect sunlight, ensuring that the solar panels maintain an optimal angle. An Arduino microcontroller processes sensor data and controls actuators, motors and the pneumatic cylinder, to adjust panel orientation in two-axis trackers. To enhance the security of the system, a wind speed sensor is added to protect our panels in adverse weather conditions. Our low-cost solar tracker offers a practical solution for increasing energy production in solar installations. This article provides detailed information on the tracker's design, component selection, and control strategies, with a focus on its affordability and potential impact on sustainable energy production.

Keywords: Solar Energy, Photovoltaique panels, Solar tracker, Arduino board, Low-cost design,

Numerical simulation of natural convection heat transfer of nanofluid in an inclined cavity using lattice Boltzmann method

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Abstract

This work applied the Lattice Boltzmann Method (LBM) to investigate the effect of sinusoidal boundary condition on natural convection heat transfer in an inclined square cavity filled with a Cu/water nanofluid. The effects of thermal Rayleigh number (Ra), nanoparticle volume fraction (Φ) and periodicity parameter of sinusoidal boundary condition (*N*) on heat and fluid flows are investigated. It has been observed that by increasing the Rayleigh numbers, a linear variation of the heat transfer is obtained with the addition of nanoparticles. Moreover, heat transfer is an increasing function of Rayleigh number and the effect of periodicity parameters (*N*) on heat transfer of cavity becomes obvious at high Rayleigh numbers. In addition, results show that LBM is an efficient method for the prediction of nanofluids heat transfer, thermal boundary conditions and consequently nanofluids heat transfer using LBM will be useful for practical applications.

Keywords: Lattice Boltzmann method, Natural convection, Nanofluid, Square cavity, Sinusoidal boundary condition.

Graphical abstract

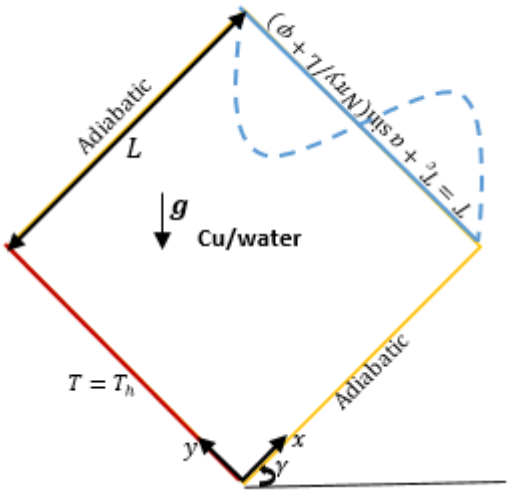

Fig.1. Geometry and boundary conditions of the problem.

Simulation numérique d'un écoulement monophasique dans un milieu poreux en présence d'une singularité

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Résumé

La mécanique des fluides dans les sols, considérés comme milieux poreux, est une branche particulière de la physique et sa compréhension revêt une grande importance dans l'exploitation d'un gisement pétrolier.
L'étude des écoulements de fluide dans les roches et les sols est une étape très importante dans le domaine des hydrocarbures. De même, la classification des couches géologiques se traduit aussi par la perméabilité à un écoulement de fluide à travers ces réservoirs naturels.
Dans ce contexte, l'objectif de ce travail est la compréhension des effets de la singularité, la porosité et de la perméabilité sur l'écoulement d'un fluide Newtonien et monophasique dans un milieu poreux de faible porosité. De même, les effets de la variation du nombre de Reynolds ont été considérés dans cette étude.
Les modèles mathématique et physique de ces écoulements ont été validés par une base de données expérimentales disponible dans la littérature.

Mot clé : milieu poreux, simulation numérique, monophasique, pertes de charge

Résumé graphique

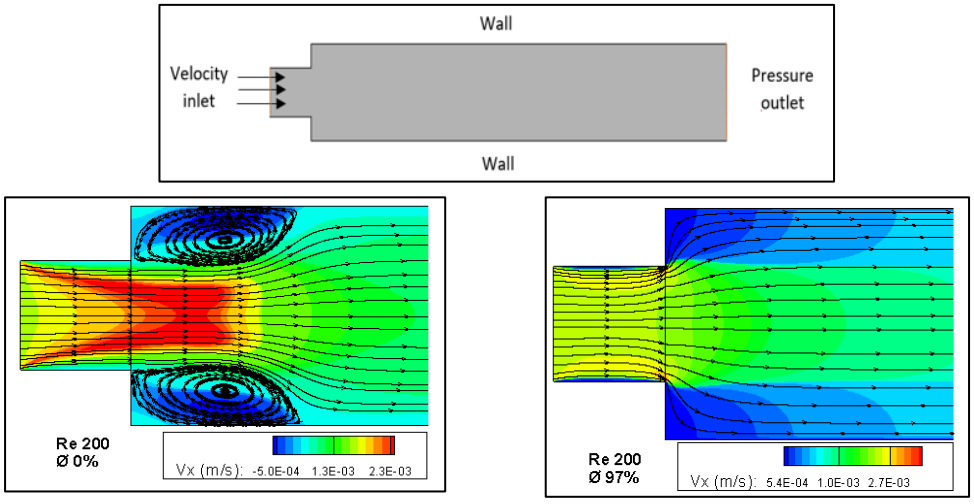

Fig.1. Configuration du canal étudiée avec les conditions aux limites imposées.

A new simplified procedure for parameter extraction of solar cell based on single diode model

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Abstract

A new procedure for the determination of the fundamental illuminated solar cells parameters (the series resistance **Rs**, the ideality factor **n**, the saturation current **Is,** the photocurrent **Iph,** and the shunt conductance **Gsh**) is presented in this paper. The suggested technique uses the illuminated current–voltage **(I –V)** characteristics and the voltage dependent differential slope curve **δ** of solar cells. The procedure is verified using simulated and experimental **I-V** curve of different solar cells and modules, and for proving its significance, the extracted values are compared with the calculated values obtained by other methods. Results obtained are very good, and show the accurate of method for extracting solar cells parameters.

Keywords: Solar cells, series resistance, shunt conductance, Extraction.

Graphical summary

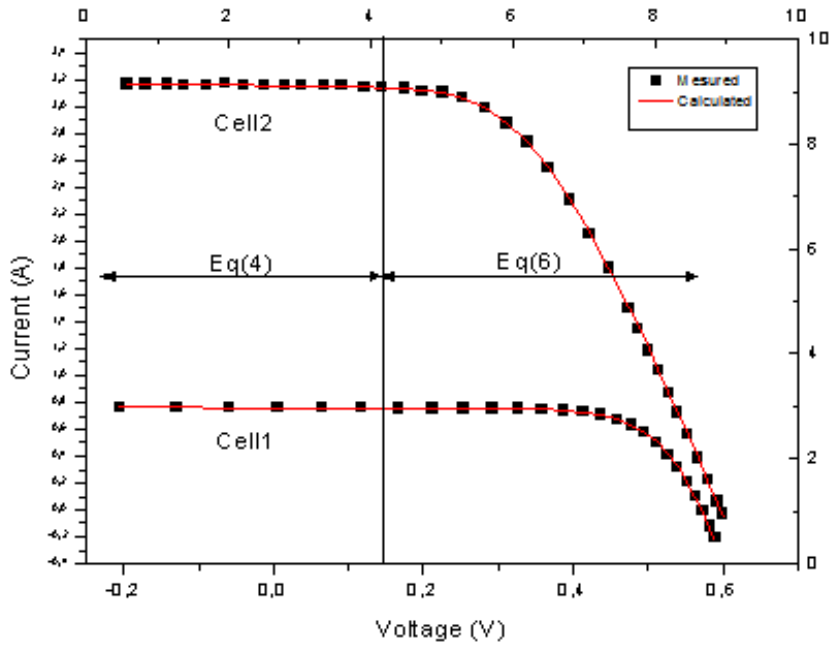

Fig.1. Experimental data (■) and the fitted curve(—) for different silicon solar cells.

Simulation d'un échangeur air-sol EAHE via le réseau ANN en climat Saharien pendant la période hivernale

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Résumé

Un échangeur air-sol (EAHE) est un composant de bâtiment de refroidissement et de chauffage à faible consommation d'énergie. Il utilise le stockage thermique du sol pour amortir les oscillations de la température de l'air ambiant en acheminant l'air à travers un conduit enterré horizontalement. Les chiffres de régression montrent la validation de l'estimation de l'hypothèse, où l'on peut voir sur tous les chiffres de régression pour l'entraînement, la validation, le test et globalement, la capacité de notre réseau neuronal à prédire la température de sortie de l'échangeur thermique air-sol.

Les résultats de simulation montrent que la meilleure architecture est choisie lorsque le MSE est dans la valeur minimale qui correspond à l'architecture de 10 neurones cachés pour la validation suivie de l'architecture de 15 neurones cachés. L'algorithme développé est adapté au calcul de la température de l'air de sortie de l'échangeur EAHE. Le modèle ANN utilise le taux de reconnaissance représenté par R2 (R-squared) allant jusqu'à 0.97.

Mots clés : EAHE, ANN, Géothermie, MSE, Réseaux de neurones, Prédiction, Température de sortie, Régression

Étude des propriétés thermiques effectives d'un matériau d'argile renforcé avec des déchets à différentes Pourcentage

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Résumé

Dans ce travail, une étude expérimentale et numérique a été menée sur un matériau composite à base d'argile et de sciure de bois dans le but d'améliorer ses propriétés thermiques. Le coefficient de conductivité thermique est déterminé à la fois par des expériences et des simulations numériques. Les résultats obtenus montrent une diminution du la conductivité thermique avec l'augmentation du pourcentage massique des particules de bois. Pour les simulations numériques, les dimensions des particules de bois sont établies pour différentes fractions massiques. Les éléments de volume représentatifs (VER) sont générés dans COMSOL MULTIPHYSIQUE.

Mot clé : Simulation numérique, Composite Argile-Bois, Homogénéisation, VER.

Résumé graphique

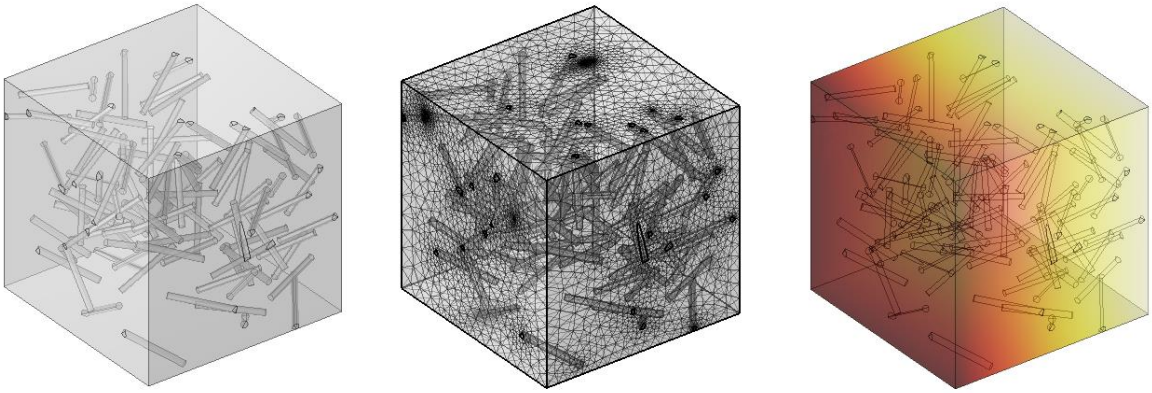

Fig.1. Modèle VER 3D, maillage 3D et distribution thermique.

Optimal Allocation of Multiple DGs and Capacitor Via Honey Badger Algorithm (HBA) in Radial Energy Distribution

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Abstract :

There is increasing growth in load demands and so is the financial pressure to modernize the current electricity distribution system. The system faces challenges such as power losses, voltage deviations, unreliability and voltage instability. In the wake of environmental and energy crises, there is also a sense of responsibility to adopt distributed energy renewable resources for power generation. Recently, integration problems can be solved by optimally allocating distributed generators (DGs) and capacitor banks (CBs) to various suitable locations in radial energy distribution, which have become increasingly popular due to their sustainability and lack of pollution, optimal allocation is a non-linear problem that is solved by powerful metaheuristic optimization algorithms. In this paper, an objective function is introduced for optimization algorithm and demonstrated by application to the IEEE 33-bus radial distribution system with different scenarios: type I DG, type III DG and capacitor banks (CB). In addition, the effects of simultaneously integrating one or more Type I DGs with Type III DGs are illustrated using the Honey Badger Algorithm (HBA), and a comparison is made with the Grey Wolf Optimization Algorithm (GWO), Whale Optimization Algorithm (WOA). The purpose is to boost improving the voltage profile and minimize the cost of energy losses, the cost of DG sources and the cost of compensators under technical and economic constraints. , respecting the equality and inequality constraints tested on the IEEE 33-bus radial distribution system (RDS).The results obtained are then compared with each other to identify the best tool in terms of convergence characteristics and best-quality solution. The results show that (HBA) faster the best solutions, achieving accurate and optimal results in just a few iterations.

Keywords: Energy Renewable, HBA, PV, Optimal Allocation, DGs, CBs, Operating cost, Power Loss.

Étude comparative technico-économique du système photovoltaïque dans deux sites différents algériens

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Abstract

L'énergie solaire possède le plus grand potentiel énergétique parmi tous les types d'énergies renouvelables. Au cours des 5 dernières années, la demande annuelle d'électricité dans le monde s'est élevée à 22 964 TWh. Chaque jour, la Terre reçoit environ 174 PW sous forme d'irradiation solaire. Ce travail vise à évaluer la faisabilité techniquo-économique de systèmes photovoltaïques sur 2 sites algériens par le logiciel SAM. Les résultats ont montré que le LCOE le plus bas dans la région d'Adrar par rapport au site de Ghardaïa, cela signifie que l'installation et l'application et la faisabilité sont recommandées dans le premier site.
De plus, l'énergie annuelle produite sur le site d'Adrar (9 060 kWh) est supérieure à celle du site d'Ouargla (8 891 kWh).

Keywords : LCOE, Logiciel SAM, Faisabilité technico-économique, Système photovoltaïque.

Numerical investigation of convective flow characteristics in a partially heated channel using an hybrid nanofluid.

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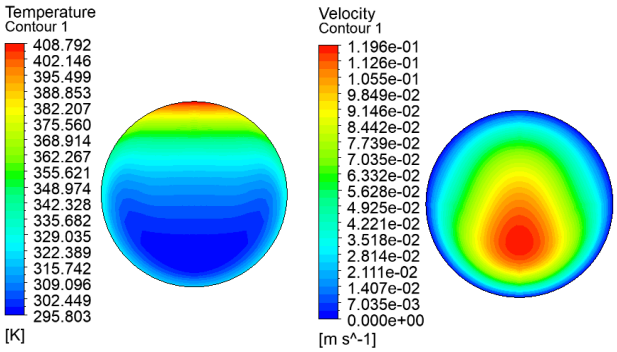
Abstract:

In this investigation, we employed 3D numerical simulations to explore the phenomenon of mixed thermal convection within an incompressible laminar flow of nanofluids inside a partially heated cylindrical channel. Our study had a dual focus: examining mixed heat convection in a laminar regime using a hybrid nanofluid, both with and without the presence of a porous medium. Our analysis encompassed the evaluation of temperature profiles, velocity fields, and heat distributions within the hybrid nanofluid. Our findings illustrated that the incorporation of nanoparticles augmented the effective thermal conductivity of the base fluid, thereby enhancing heat transfer. Notably, the Al_2O_3-CuO-water hybrid nanofluid exhibited particularly impressive thermal conductivity. Furthermore, the introduction of a porous medium with high permeability and conductivity significantly improved the heat transfer process.

Keywords: Nanofluid, porous medium, mixed heat convection, laminar flow, finite volume method, CFD, Nusselt number

Graphical abstract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395.499
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335.682
329.035
322.389
315.742
309.096
302.449
295.803
[K]
Velocity
Contour 1
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1.055e-01
9.849e-02
9.146e-02
8.442e-02
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7.035e-02
6.332e-02
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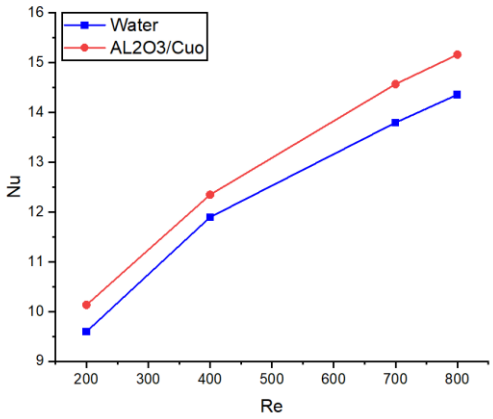
Water
AL2O3/Cuo
Nu
Re
16
15
14
13
12
11
10
9
200
300
400
500
600
700
800

Valorization of Hot pepper wastes from local industry in a fluidized bed reactor

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Abstract

Utilizing hot pepper waste, a prevalent byproduct of the agro-food industries, this study delves into its potential as a feedstock for the gasification process. The investigation on its physicochemical attributes and to assess its compatibility with gasification. Through comprehensive experimentation, the gasification procedure was fine-tuned to maximize its efficiency, with a detailed analysis of the outlet gas mixture and the process's overall conversion efficacy under varied operational settings.

The findings reveal that converting hot pepper waste via gasification in a bubbling fluidized bed reactor emerges as a viable and eco-friendly strategy for repurposing agricultural byproducts. The syngas generated, enriched with hydrogen and carbon monoxide, presents promising prospects for diverse energy-centric applications, encompassing power generation and the synthesis of biofuels. This methodology not only mitigates the environmental quandaries linked with the disposal of agricultural refuse but also harbors the potential to bolster the economic landscape of local communities.

This research enriches the existing literature on eco-conscious waste management and the generation of renewable energy, spotlighting gasification as an effective technique for tackling agricultural waste in Algeria. Furthermore, it accentuates the necessity for innovative approaches that harmonize environmental preservation with energy generation, steering towards a more resilient and circular economy.

Key words: biomass; gasification; energy; Fluidized bed reactor.

Optimization and Performance Enhancement of a Grid-Connected Photovoltaic Power Plant: A Case Study in Ghardaia

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Abstract:

This paper focuses on the study and analysis of the performance of a photovoltaic power plant located in the Ghardaia region. The optimal exploitation of electrical energy generated by the photovoltaic generator can significantly contribute to reducing the overall system cost. The first section of the presentation provides an overview of the grid-connected photovoltaic power plant situated at Oued Nechou in Ghardaia, highlighting its various components. The second section is dedicated to the simulation of the grid-connected photovoltaic system, illustrating the operations involved in managing the voltage produced by the PV generator to meet the load requirements. The issue of harmonics is addressed, and the spectral analysis of current and grid voltage reveals the impact of harmonic disturbances on the energy quality supplied by the photovoltaic power plant. Simulation results demonstrate the effectiveness of incorporating a filter at the inverter output to enhance the quality of voltage and current injected into the grid. This research contributes valuable insights into optimizing the performance of grid-connected photovoltaic systems, specifically addressing harmonic challenges for improved energy quality.

Keywords:

Photovoltaic Power Plant, Performance Optimization, System Cost Reduction, Simulation Results

Numerical Simulation of Different Tandem Darrieus Wind Turbine Configurations

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Abstract

Tandem Darrieus wind turbines offer promising potential for enhancing wind energy harvesting efficiency through innovative configurations. This study employs numerical simulation techniques to investigate various tandem Darrieus wind turbine configurations and assess their performance characteristics. The simulations are conducted using computational fluid dynamics (CFD) models to analyze the flow behavior, aerodynamic forces, and power output of different tandem configurations under varying wind conditions. The research focuses on evaluating the aerodynamic interactions between the tandem blades, including wake interference and mutual induction effects, to optimize the turbine arrangement for improved performance. By systematically varying parameters such as blade geometry, rotor spacing, and orientation, a comprehensive analysis is performed to identify optimal tandem configurations for maximizing power generation and minimizing load fluctuations. The findings of this research provide valuable insights into the design and optimization of tandem Darrieus wind turbines, contributing to the advancement of renewable energy technology and facilitating the deployment of efficient and sustainable wind power systems. Furthermore, the numerical simulation approach offers a cost-effective and time-efficient means of evaluating different turbine configurations, enabling informed decision-making in wind energy engineering and design.

Keywords : DARRIEUS wind turbine, Tandem, Power coefficient, TSR, Aerodynamics coefficients.

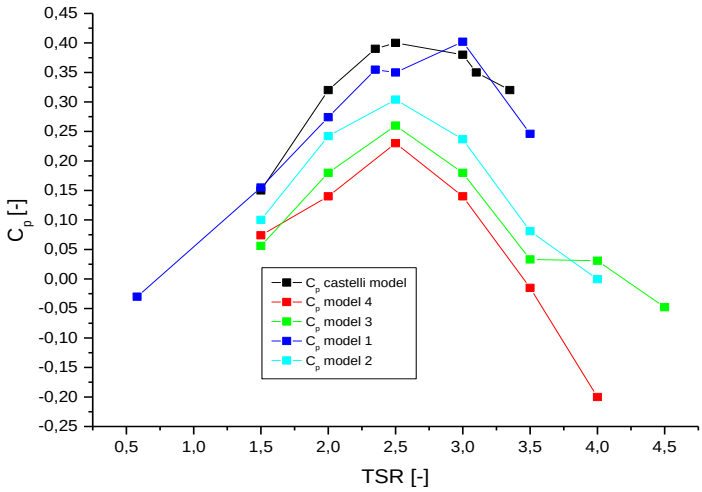

Fig.1. Power coefficients as a function of tip speed ratio.

Solar Heating of Rural Houses in Algeria Based on Sensible Heat Storage System

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Abstract:

This work focuses on the feasibility study of solar heating for rural houses in Algeria, by dynamic energy calculations, hour by hour, over one year. The study aims to deciding the technical conditions of autonomous solar heating of a reference house located in a region with a continental climate. Regions with no connection to electricity and gas grids would be the first application target. The reference case is a detached single-family one-story residential building located in Batna region. TRNSYS software is chosen as a dynamic simulation tool in this work. The results show that integrating thermal insulation and double-glazing in the house envelope may decreases the heating energy consumption of the house by about 4.66 MWh. Then, technical parameters and optimization considerations are presumed for the solar heating system. Tow schemes with different sizes and connections are tested. In the first scheme (S1), the storage system is with single storage tank (2.8 m^3), and the second scheme (S2) is equipped with a seasonal sensible storage (8m^3) and a new control strategy. The results show that using the S1 system, the solar heating system provides 73% of the total heating needs. Furthermore, the S2 system met the majority of heating energy demand for the house; that's about 95%.

Keywords: Solar heating system; TRNSYS simulation; Continental climate; Typical building; Solar share.

Graphical summary

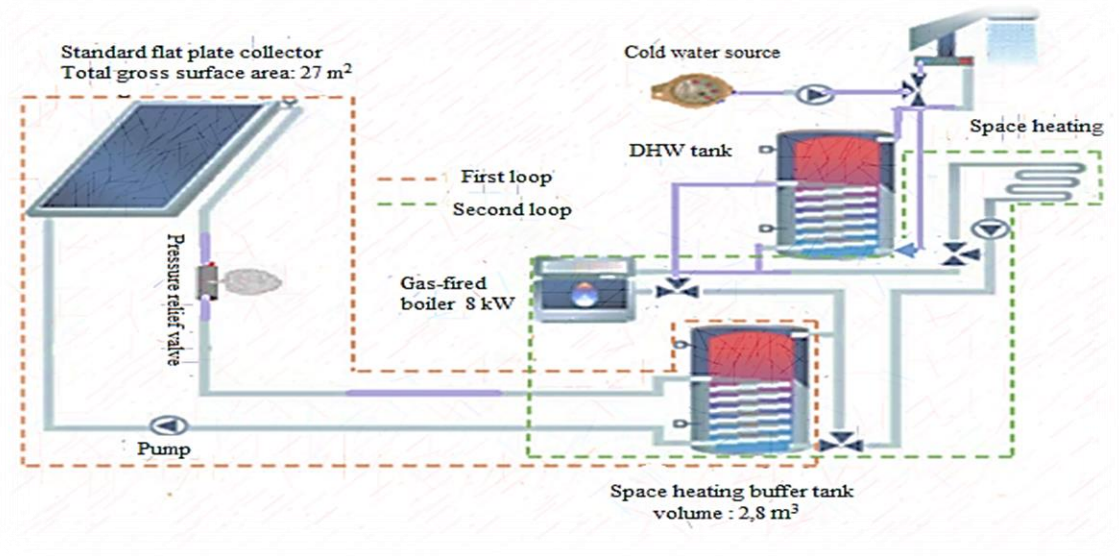

Fig.1. Schematic of the solar heating system; S1 system.

Effect of Charge and Discharge Strategies on the Performances of Sensible Solar Water Heating System

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Abstract

This work presents the influence of the charging and discharging manner of solar thermal energy captured by the solar collector field on the performances of a solar hot water heating system (SWHs). The SWHs is utilized to meet the thermal demand of a typical rural house located in Batan region, Algeria. In this context, three SWH systems with different approaches to storage and distribution of sensible solar thermal energy among the solar collector field, multi tank storage, and the load were compared with a conventional SWHs (S1). The first system is with multi-tank charging and discharging in series (S2), the second is with multi-tank charging and discharging in parallel (S3), and the third system is with multi-tank charging in series and discharging in parallel (S4). In this work, dynamic energy calculations are performed hour by hour over one year, with TRNSYS software chosen as the dynamic simulation tool. The simulation results demonstrate that SWHs with multi-tank charging in series and discharging in parallel (S3) provide the best approach to meet the thermal demand of the rural house with a solar share of 46%.

Keywords: Sensible heat storage; Multi tank strategy; Solar heating system; TRNSYS simulation; Solar share.

Graphical summary

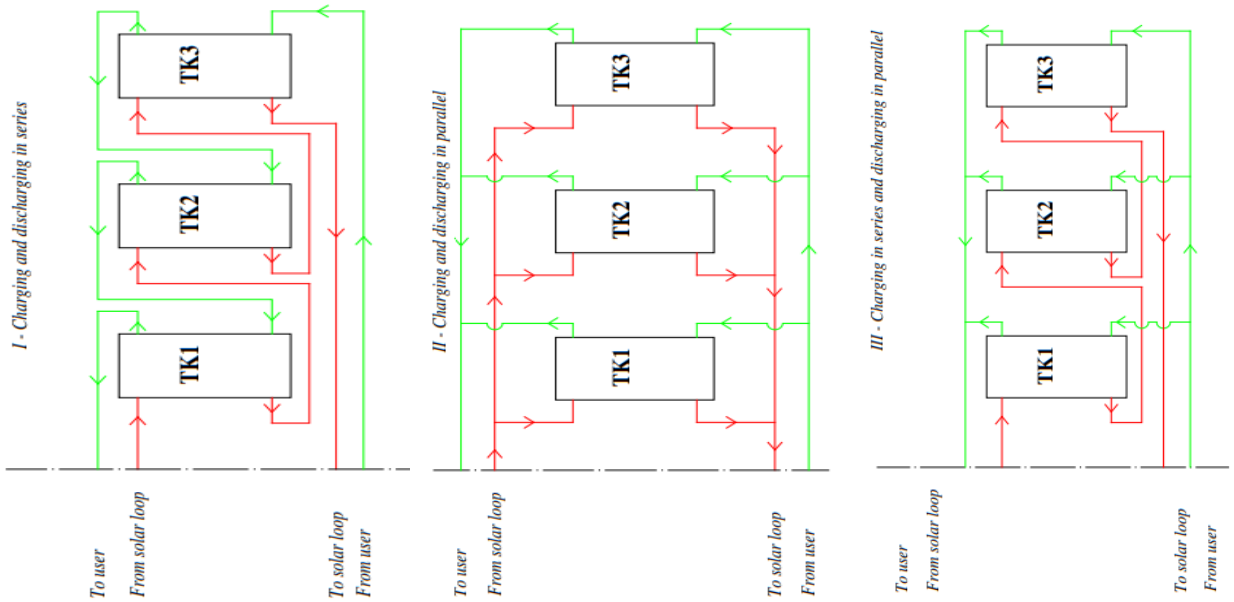

Fig.1. Schematic of multi-tank layout strategy; S2, S3 and S4 systems.

Enhancing Energy Efficiency for Simultaneously Optimal Photovoltaic DG and DSTATCOM Integration in Adrar City Power Distribution System

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Résumé

The energy management system of distribution systems, with the integration of multiple Distribution Static Compensator (DSTATCOM), provides numerous benefits and significantly differs from the existing distribution systems. The proposed procedure were formulated as Multi-Objective Optimization (MOO) algorithm based on minimizing the Real Power Loss (RPL), and Total Voltage Deviation (TVD) in Distribution systems is deployed to determine the optimal allocation, of Photovoltaic DG, using various Multi-Objective Particle Swarm Optimization (MOPSO) algorithms based the varying inertia weight. These MOIWPSO algorithms are the Inertia Weight with Butterworth (MOB-PSO), Adaptive Inertia Weight (MOAIW-PSO), Chaotic Decreasing Inertia Weight (MOCDIW-PSO), and Exponential Inertia Weight (MOEIW-PSO). The efficiency of the proposed MOPSO algorithms is validated using test cases that are standard distribution IEEE 33- and IEEE 69-bus. The simulation results prove that the MOEIW-PSO algorithm exhibits higher capability and efficiency in finding optimum solutions that reduce the power loss and enhances the voltage profile in Microgrids.

Mot clé : Distribution static compensator (DSTATCOM), Optimal Allocation, Inertia Weight Particle Swarm Optimization, MOPSO, Multi-Objective Function, Distribution System.

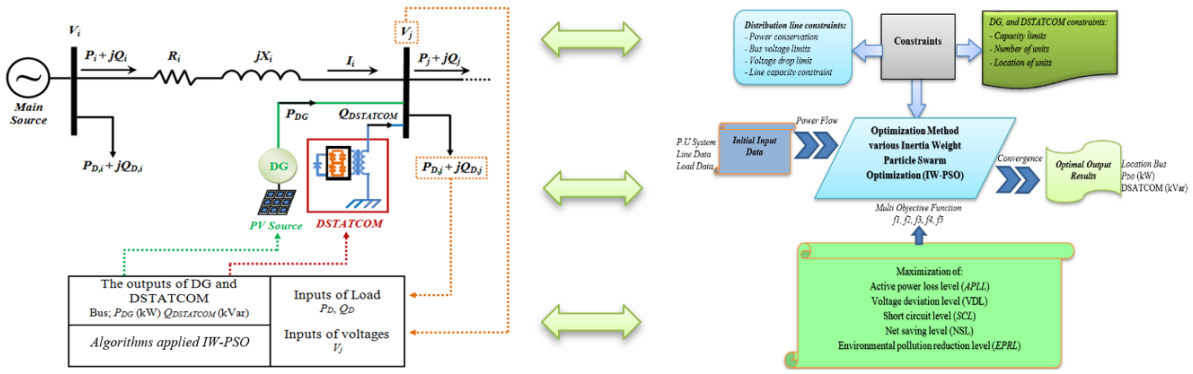

Fig 1. Summary of the optimization model.

Control of the UPQC filter associated with a PV system

Noureddine Khenfar, and Abedlhafid Semmah

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Résumé :

In this study, we aimed to develop a hybrid active UPQC filter system and control its DC bus using fuzzy logic compared to a traditional PI controller. This was integrated with a PV system utilizing an MPPT algorithm implemented through fuzzy sets. The work was conducted using MATLAB and the results were effectively validated, demonstrating enhanced performance of the DC bus in terms of renewable energy utilization.

Mots-clés : UPQC filter ;fuzzy logic ;DC bus ;PV;MPPT.

Contribution of renewable energies in the residential sector to meeting energy requirements

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Résumé

Solar energy is an intelligent solution at the service of man and the environment. The sun can meet our needs if we learn to rationally use the energy it emits toward the earth. Today, it seems insane not to take advantage of it because we have the necessary technological means. Moreover, we must consider that this energy source is free, clean, and inexhaustible. This energy could also free us from dependence on fossil fuels or other unsafe or polluting alternatives. The choice of a photovoltaic solution represents an investment whose payback time is easily calculated thanks to software that helps evaluate costs and different economic data. Our work is a modest contribution to integrating an autonomous photovoltaic system into the residential sector to meet the energy needs of a house in Constantine, Algeria.

Mot clé : Renewable energy, Energetic needs, Residential photovoltaic installation, Solar energy

Résumé graphique

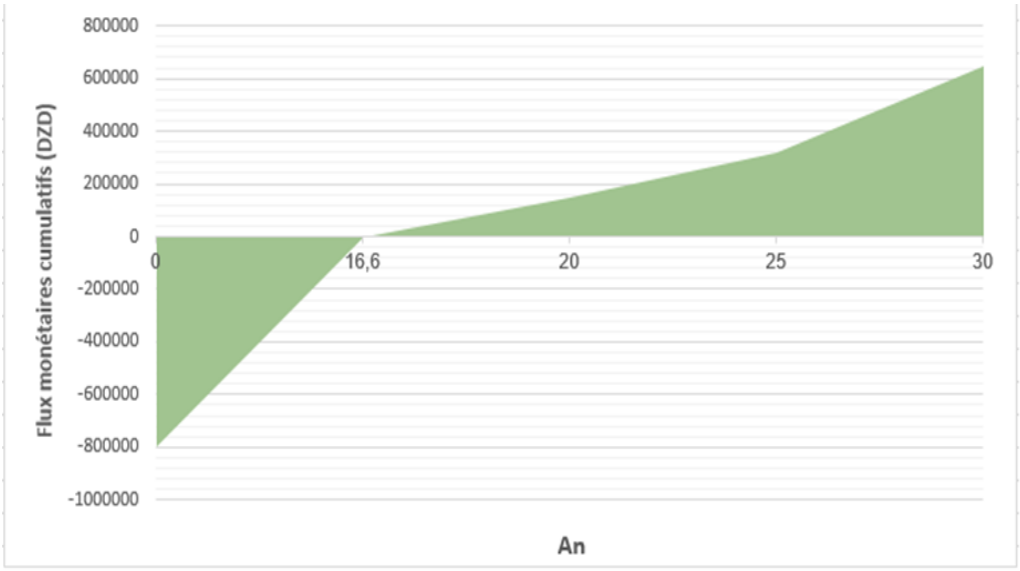

Fig.1. Etude technico-économique de l'installation analyse de cout.

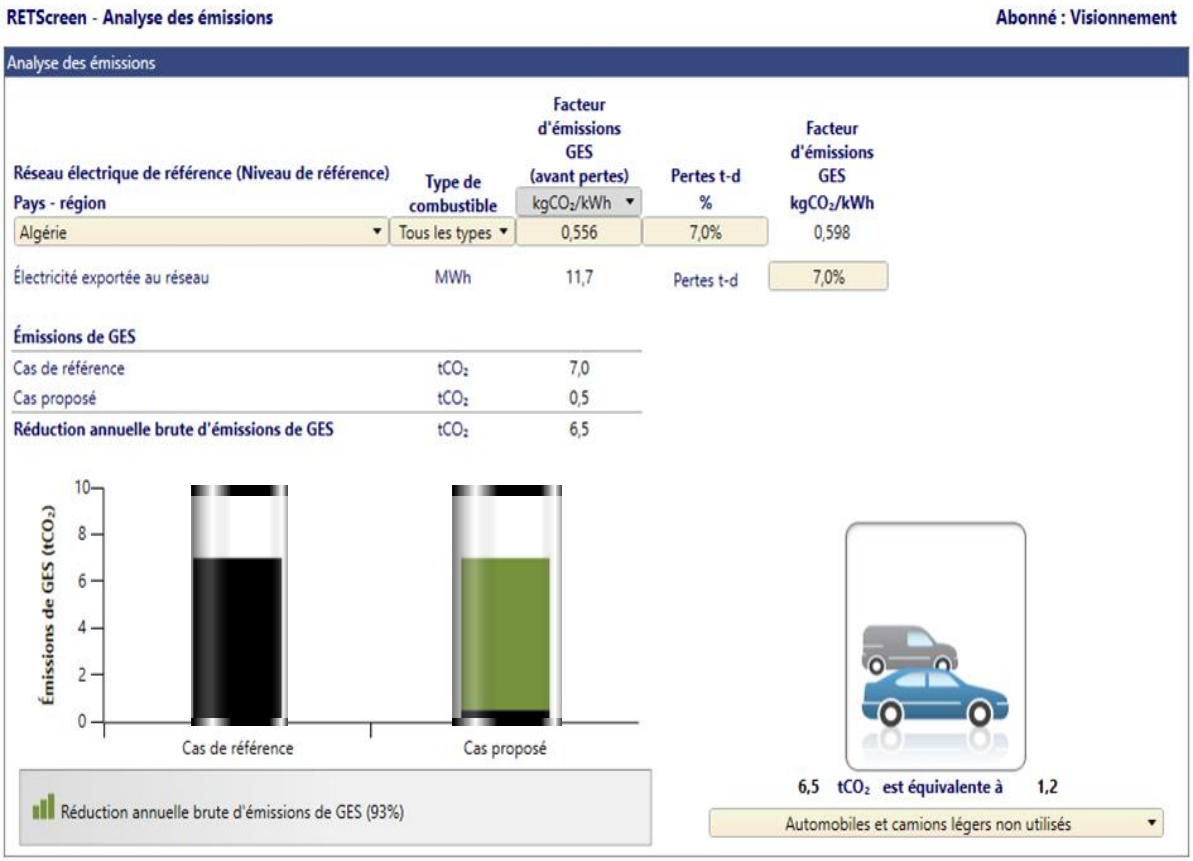

Fig .2. Analyse des réductions d'émissions de GES

Etude des paramètres et performances d'un distillateur solaire symétrique

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Résumé

Notre travail consiste à étudier expérimentalement et théoriquement un distillateur solaire de type chapelle. Des essais de production d'eau distillée ont été réalisés avec de l'eau de puits ayant une conductivité. L'étude numérique du système par l'application de la méthode des différences finies, nous a permis de mieux voir l'évolution temporelle des températures, la variation des caractéristiques de fonctionnement du distillateur telles que le rendement interne, le rendement global, le rendement et le facteur de performance .

Le programme développé a été validé par l'étude comparative de résultats théoriques et expérimentaux pris dans les mêmes conditions. Les mesures effectuées par notre programme dans les mêmes conditions en ce qui concerne les températures, le flux solaire ont été vérifiées par des mesures effectuées expérimentalement sur un distillateur réalisé au niveau du laboratoire dans les conditions climatiques de la ville de Tipasa.

Le jour du 15 juillet a été choisi pour le calcul, de la productivité journalière en eau distillée. Au cours de cette journée, la production a atteint 5,2 litres ; sous un rayonnement de 1015,75 w/m2 induisant une température ambiante de 37,5°C avec une saumure atteignant 70,9°C, le rendement interne nominal est de 35,23% avec un rendement global de 53,42% et un facteur de performance de 2,33.10-4 l/kJ.

Mot clé : Distillateur solaire; Différences finis; Méthodes des nœuds; Efficacités; Températures

Modélisation et optimisation des rendements énergétiques par plan d'expériences

Benlamnouar Mohamed Farid[1], Ziam Aymen[2], Rezigue menaouer Farouk[2], Haouas Ghous[2], Nabil Bensaid[1]

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[2] *Ecole Nationale Supérieure de Technologie et d'Ingénierie– Annaba(ENSTI)*

Résumé :

De nombreux facteurs de production jouent un rôle crucial dans la détermination de l'efficacité et de la productivité des systèmes d'énergie solaire. Ces éléments comprennent le rendement du rayonnement solaire en tant que principale source d'énergie, la qualité des cellules solaires qui convertissent la lumière du soleil en électricité, ainsi que les angles et orientations des modules solaires. Les conditions météorologiques, y compris la présence de nuages, ainsi que la température, exercent également une influence sur l'efficacité des cellules solaires. L'objectif de cette étude est d'optimiser la production d'électricité renouvelable en identifiant les facteurs optimaux qui garantissent une productivité élevée, en utilisant la méthodologie des surfaces de réponse (RSM) qui inclut un plan d'expériences.

Mots-clés : RSM, Rayonnement solaire, Plan d'expériences, Température, Rendement énergétique, Cellule solaire.

Exploring enhanced efficiency in perovskite solar cells CsSnCl3 using SCAPS-1D software

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Abstract :

In recent years, double perovskites have garnered significant attention in the realm of renewable energy due to their promising properties for use in solar cells. The performance of these cells is influenced by a range of factors. These include the architectural design, the specific material chosen for the active layer, and the methodologies utilized for the fabrication and preparation of the different layers. The aim of this study is to explore the performance of a perovskite solar cell (PSC) featuring a CsSnCl3 active layer using SCAPS 1-D. We examine alterations in the electron transport layer (ETL), the hole transport layer (HTL), the thickness of the active layer, and the device temperature to enhance efficiency. The solar cell, structured as (ITO/ZnO/CsSnCl3/CBTS), achieved a record efficiency of 22.82% at atmospheric temperature. Overall, our theoretical investigation of double perovskites provides valuable insights for fabricating solar devices and suggests their potential as highly efficient active materials in photovoltaic applications.

Keywords: Perovskite CsSnCl3, SCAPS-1D, high efficiency, optimization, solar cells.

Graphical Abstract

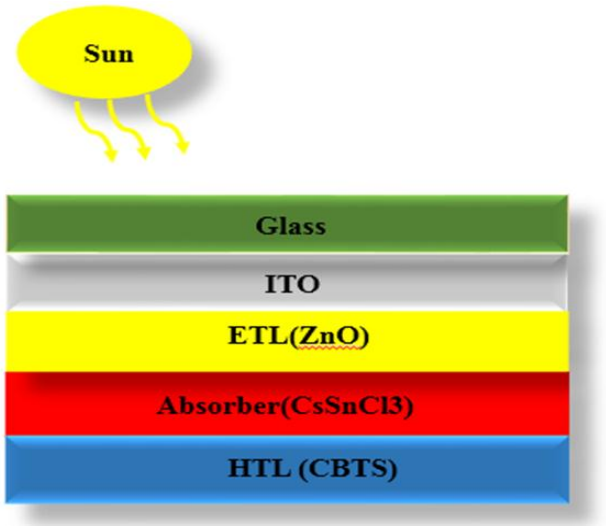

Fig.1. Architectural design configuration of LF-PSCs based on a CsSnCl3 perovskite light-absorber.

A Numerical Analysis of Porosity's Effect on Thermal Performance of Parabolic Trough Collector Receiver Tube

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Abstract

In this study, numerical simulations were employed to investigate the heat transfer within the absorber tube of a solar parabolic trough collector (PTC). A novel concept for the absorber tube of PTC is presented, aiming to enhance heat transfer between the absorber tube and the heat transfer fluid through the integration of a semi-porous medium. The computational fluid dynamics (CFD) software tool, Ansys-Fluent, is employed to conduct a two-dimensional steady-state investigation, involving the solution of equations for mass conservation, momentum, and energy. The primary objective is to analyze thermal performance by enhancing convection within the porous matrix, promoting heat homogenization in the heat transfer fluid, and, crucially, achieving the maximum temperature at the outlet. A parametric study is carried out by proposing flows for three different Reynolds numbers: 500, 1000, and 1500, and three different porosities (0.90, 0.95, and 0.80). Forced convection occurs within the absorber tube, in which seven identical matrices are inserted at equal distances of 100 mm. The results obtained demonstrate the influence of the matrices on the heat exchange between the absorber and the heat transfer fluid Syltherm-800 in our case, particularly at the level of the porous matrix. The proposed configuration shows a clear increase in the Nusselt number with decreasing porosity. This configuration promoted an increase in outlet temperature, the heat flow gradient in the absorber tube wall reduced and thereby homogenizing heat transfer in the fluid.

Keyword: PTC, Semi-porous medium, friction factor, Nusselt number.

graphical summary

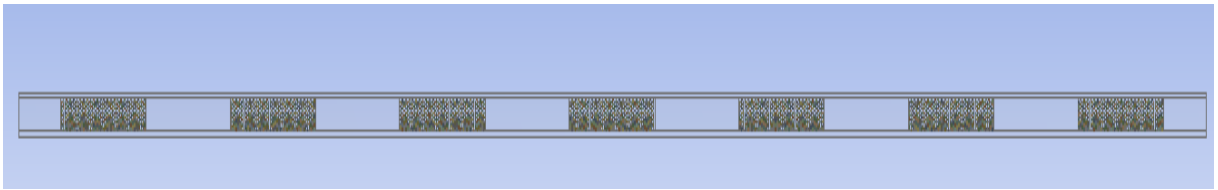
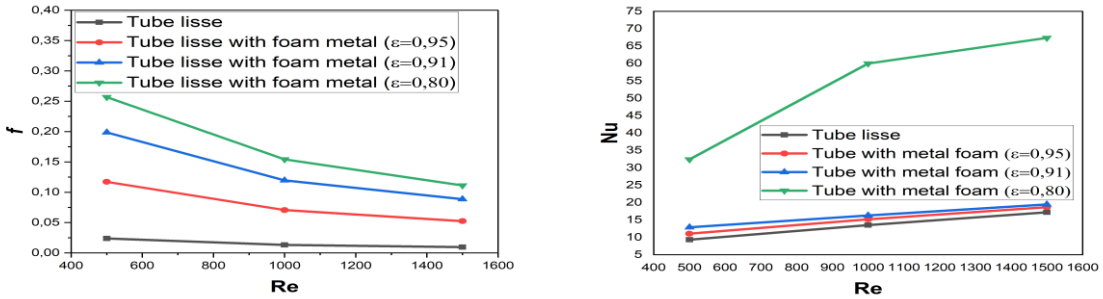


Fig.1. Schematic of the absorber tube with seven pieces of copper porous media**.**



(a) (b)

Fig. 1. The effect of different porosity of metal foams compared with tube lisse: a) friction factor, b) Nusselt number.

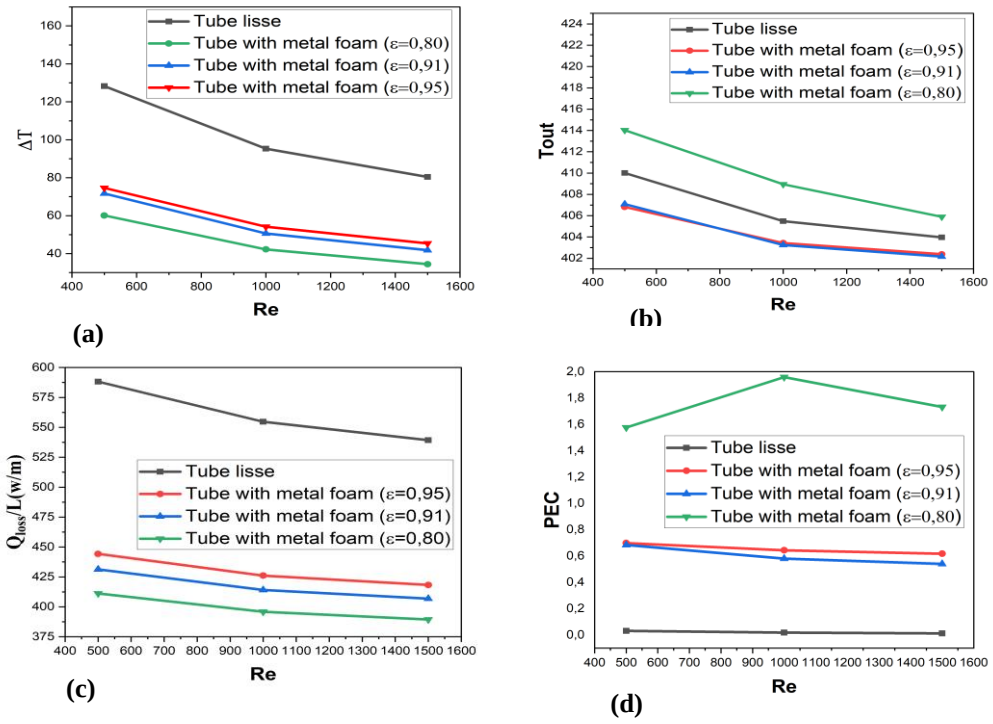


Fig. 3. variables through the Reynolds number: a) outlet temperature, b) the temperature gradient between the tube surfaces c) heat loss per unit length, and d) Performance evaluation criteria.

Simple and effective control and optimization of a wind turbine based on a PMSG

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Abstract :

Nowadays, the contribution of renewable energy sources in the production of electrical energy have been drastically increased. This will protect the environment and reduce the dependency of the fossil fuel, coal and petroleum. Wind power is most quickly growing renewable and clean energy source. The wind energy conversion system based permanent magnet synchronous generator variable speed wind turbine is one of the most promising systems due to its efficient energy production and its simple structure. In this work, a new fractional order fuzzy logic controller for variable speed wind energy conversion system to maximizing energy capture from the wind and to improve the system performance, the system studied consists of a wind turbine, a permanent magnet synchronous generator and a power electronic converter. The proposed control strategy is composed of two parts. Firstly, a fractional reference model of the PMSG-WT nonlinear system is provided using Takagi-Sugeno (T-S) fuzzy model and fractional calculus in order to ensure an accurate and robust model of the system. Secondly, the feedback controller gains are determined by resolving a set of linear matrix inequalities. We have used a random profile of wind speed in order to demonstrate the validity and the effectiveness of the proposed strategy. The disadvantage of classical Fuzzy logic controller is eliminated by using a fractional order controller. The result of the simulation shows good performance of the used method.

Key words: Wind system; turbine; permanent magnet synchronous generator; fractional order operators; T-S fuzzy model.

System description

The zone of study of WECS in this work consists generally of three parts wind turbine, generator and power converter. A block diagram of the WECS is shown in Figure.1.

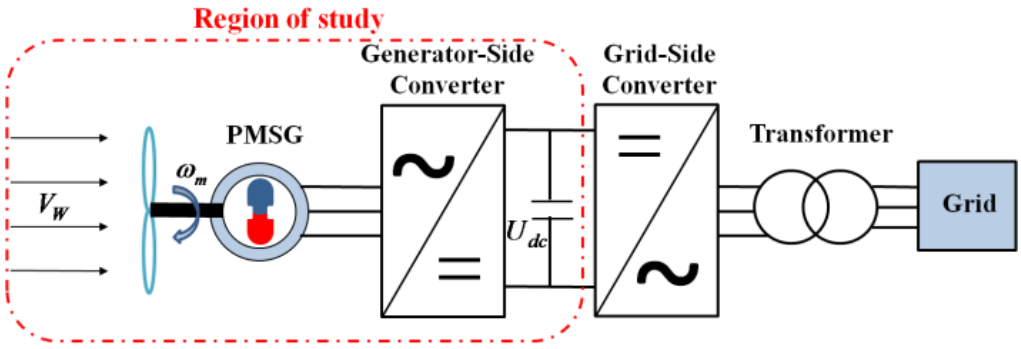

Fig.1. Block diagram of WECS.

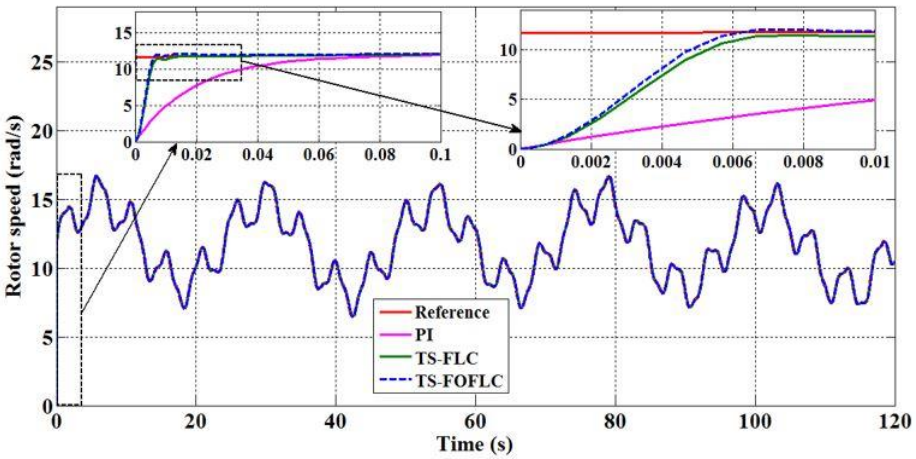

Fig.2. Rotor speed.

Investigation des performances magnéto-électroniques des matériaux demi-métalliques $III_{1-x}Cr_xSb$ pour les applications de stockage d'énergie

Naima Derou[1], Bendouma Doumi[2,3*], Allel Mokaddem[4], Bensaid Djillali[5], Abdelkader Yakoubi[3], Mohammed Sahlaoui[6], Miloud Boutaleb[7], Boumediene Lasri[8], Abdelkader Tadjer[9]

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[7] *Faculty of Sciences, Department of Chemistry, University of Saida - Dr. Moulay Tahar, Algeria*

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Résumé

Les semi-conducteurs magnétiques dilués sont des matériaux attractifs pour la spintronique et stockage d'énergie car ils combinent à la fois les comportements magnétiques et semi-conducteurs. Dans cette étude, les performances magnéto-électroniques des matériaux $III_{1-x}Cr_xSb$ à base de AlSb (III = Al) substitué par le chrome (Cr) à différentes compostions x = 0.25, 0.5, et 0.75 sont investigués en utilisant les calculs computationnels de la théorie de la fonctionnelle de la densité. Nos résultats des propriétés électroniques et magnétiques montrent que ces composés $Al_{1-x}Cr_xSb$ sont polarisés en spin de 100% et révèlent un caractère demi-métallique ferromagnétique avec des flip-gaps de 0.63, 0.56, et 0.47 eV pour les matériaux $Al_{0.75}Cr_{0.25}Sb$, $Al_{0.5}Cr_{0.5}Sb$, et $Al_{0.25}Cr_{0.75}Sb$ respectivement. Ainsi, ces composés ferromagnétiques contrôlent simultanément à la fois le degré de spin et la charge

des électrons. Par conséquent, les matériaux $Al_{1-x}Cr_xSb$ sont considérés comme une source de stockage d'énergie à intégrer dans les dispositifs spintroniques émergents.

Mot clé : Ferromagnétisme, Stockage d'énergie, Dispositifs spintroniques

Résumé graphique

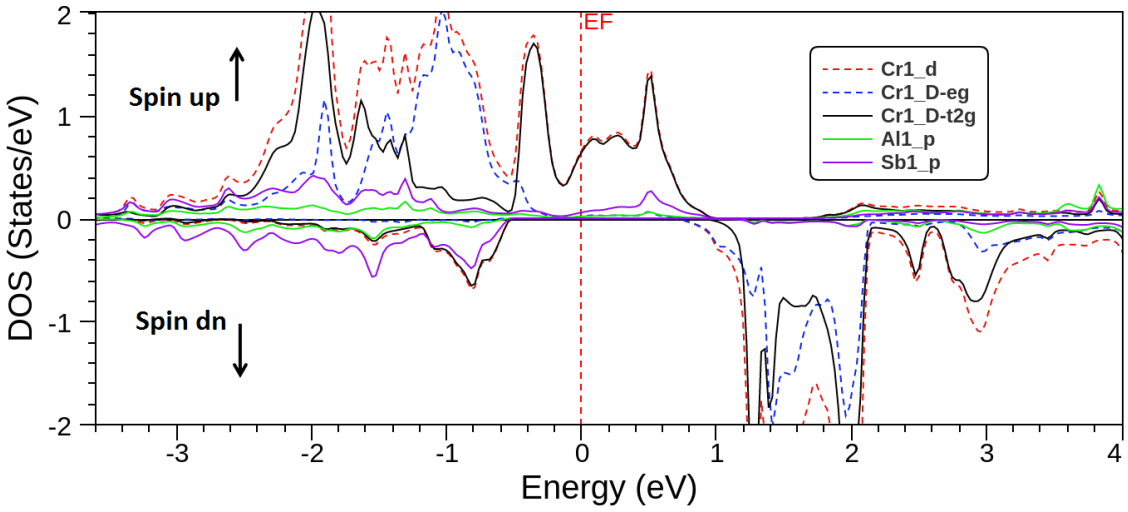

Fig.1. Comportement magnétique et semi-conducteur du matériau $Al_{0.75}Cr_{0.25}Sb$

An experimental study to improve the productivity of solar stills in the Ouargla region

Mekhloufi Naima, Soudani Mouhamed Elbar , Mohammed Mostepha Belhadj

Laboratory for the Development of New and Renewable Energies in Dry and Desert Areas

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Abstract

The sustainable growth of human civilization faces major obstacles caused by pollution of the environment and freshwater resources. This problem is solved by performing distillation. To increase the daily production of distilled water through experimental models that have been proposed and now accepted in solar distillation research, a solar distillation system was built and the utilization of solar energy was enhanced. The experimental setup and direct monoclinic approach were used in this work. On the one hand, solar energy is cheap and sustainable, and on the other hand, it is straightforward. The purpose of this project is to increase energy efficiency and productivity by improving the performance of traditional solar power plants. The experiments were based on two stills, the first a traditional solar still and the second an improved traditional solar still. The experiment was conducted on specific days in December 2023 under the climatic conditions of the city of Ouargla. The results show that the use of single-slope solar stills with a parabolic cylindrical solar collector (PTC) increases the daily productivity of conventional solar stills.

The results of the experimental research also showed that the improved distillation device produces a greater amount of water than the traditional distillation device, as the better distillation device produces 3336 ml of distilled water during the day compared to the traditional distillation device, which reaches 2987 ml. . This is the result of the thermal energy that the solar collector uses to heat the water. Which results in the production of distilled water by accelerating the evaporation of salt water.

Keywords: solar radiation, parabolic cylindrical solar collector, water desalination, solar still

Assessing the Long-Term reliability of c-Si in Algeria's desert climate.

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Résumé

Desert climate affects the durability of photovoltaic panels that leading to a drop in their lifetime. This paper explores the primary factors contributing to the degradation of c-Si in desert climates and examines the direct correlation between desert climate and the acceleration of degradation mechanisms. The study was carried out at research unit of renewable energy in Algerian Saharan middle (urerms.cder.dz), Adrar, in the extreme south of Algeria. An overview of Algeria's desert climate has been presented, is characterized by high ambient temperatures (exceeds 50 C° in summer) and high solar irradiations (exceeds 1000 w/m2). High solar irradiation accompanied by high ambient temperature has been considered as the most responsible for accelerated discoloration and initiating damage of EVA encapsulant material, which can create a challenge for long-term reliability of c-Si PV panels. Obtained results prove the performance degradation of the tested panels compared to the results obtained in the literature.

Mot clé : Algeria's desert climate, c-Si, Eva degradation, Output power, lifetime expectancy.

Photovoltaic Electricity Generating in Algeria's Desert Climate: Challenges and Perspectives.

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Résumé

Algeria is taking significant steps towards for sustainable energy transition and promoting efficient and more sustainable energy future. Algerian Sahara could capture enough solar energy to meet the electricity needs of the entire world. Harsh climatic conditions of Algerian desert create challenges for the performance, reliability, and sustainability of solar photovoltaic installations. The main contribution of this work is to examine the impact of environmental factors on energy efficiencies. Data base of PV solar plants installed in different locations in desert has been included. The findings of the analysis demonstrate the significant influence of the desert environment on the power generation performance. The study gives a clearer insight that can help researchers, manufacturers, investors, developers, and governments to develop an adequate PV solar system in hot desert climates.

Mot clé : Desert climates, Power generation, Monitoring, sustainability, Performance assessment.

Analysis of heat exchanger performances by changing nanofluid properties

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Abstract

Due to the augmentation of energy consumption in the world, the use of innovative devices permits energy consumption optimization to become a very important subject of recent scientific studies and engineering applications.

Heat exchangers are one of the most important devices related to energy and heat transfer. Their use presents a significant interest in various industries. They are principally exploited to reduce heat transfer and increase energy efficiencies. However, the reduced heat transfer properties of the fluids used in engineering applications are obstacles to using diverse types of heat exchangers.

Nanofluids are new types of fluids that have higher heat transfer characteristics due to the dispersion of solid particles that have a higher thermal conductivity in these fluids. They are most suitable for the above engineering applications because of their several potential advantages, such as their better stability and high thermal conductivity. Also, they offer an excellent environment for adding or removing energy to systems.

The objective of the present work is to focus on the heat transfer characteristics (investigate the convective heat transfer coefficients and the effect of Nusselt number) of various nanofluids (Al_2O_3/water, CuO/water, etc.) for turbulent flow in stainless steel tube of heat exchanger.

The simulations were done for a wide range of Nusselt numbers, nanoparticle volume concentrations, and different particle types.

The evolution of the heat transfer characteristics is first compared to the experimental studies and theoretical calculations published in previous scientific papers where obtained results are in good agreement with the experimental and theoretical results.

The results for considered nanofluids show that the heat transfer characteristics of nanofluids improve significantly at a certain Nusselt number of a chosen nanofluid according to an optimum nanoparticle concentration up to 4%. Al_2O_3/water gave the highest heat transfer

characteristics at higher values of Nusselt number and Reynolds number up to 4500, and CuO/water gave the highest density related to other nanofluids.

Mot clé : nanofluid, heat transfer, energy transfer, heat exchanger.

Résumé graphique

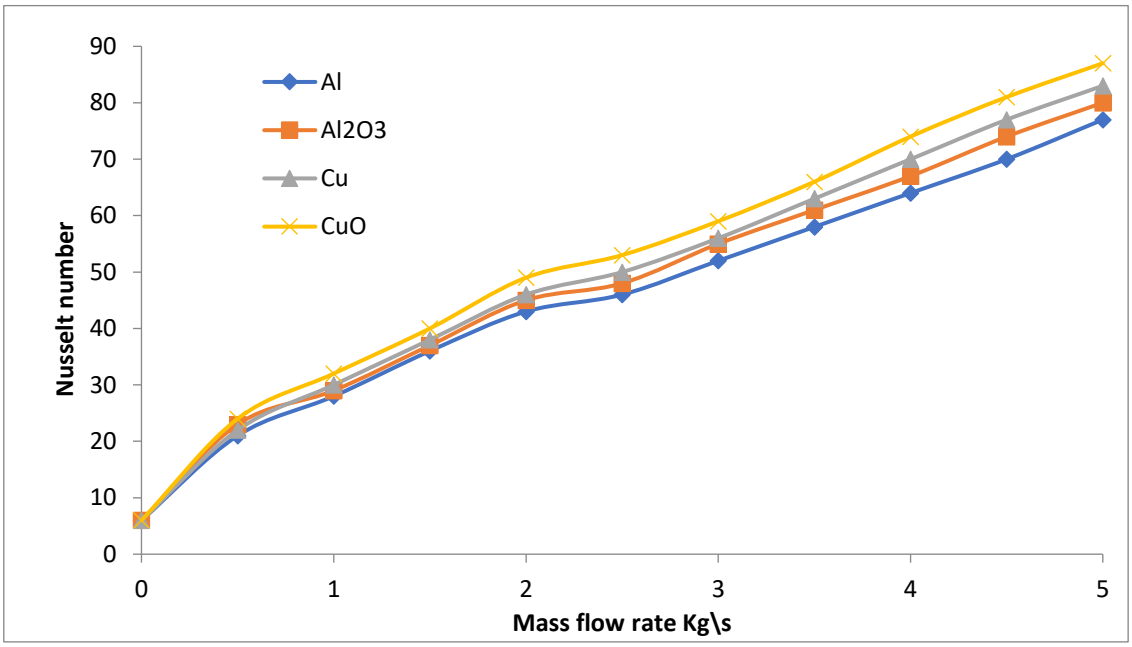

Fig.1. Evolution of Nusselt number for Φ=3.5% .

Impact of aluminium in the metallisation paste on electrical losses in n-type bifacial silicon solar cells

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Introduction: Solar cells are essential for the production of renewable energy. This study investigates the effect of aluminium in the metallization paste on the performance of solar cells.
Methodology: We used the floating contact method to isolate the specific effects of aluminium. This method allows us to study the electrical properties of a small area of the solar cell, independently of the rest.
Results: Aluminium reduces shunt and carrier recombination on the p+-emitter.
It reduces the generation and growth of silver crystallites.
Conclusion: Aluminium in Ag/Al paste does not cause significant electrical losses. The floating contact method makes it possible to analyse specifically the effects on the p+-emitter.
Key words: solar cells, silicon, n-type bifacial silicon, floating contact, doping, Ag/Al paste

Effect of seasonal variations on the electricity generation under harsh environments of Algerian desert

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Résumé: Algeria promotes renewable energy generation for a sustainable energy transition through the deployment of photovoltaic solar energy in desert regions. The work aims to analyze the impactful seasonal variations in electricity generation under harsh desert climates. In order to evaluate the performance of solar PV systems, monitoring data including climatic conditions and power production were collected and analyzed over five consecutive years at Zaouiet Kounta photovoltaic plant, which has a capacity of 6 MWp. The analyzed findings reveal that the desert environment has a significant effect on power generation performance. The study will contribute to understanding the relationships between challenges related to the desert climate and electricity generation, which are addressed to improve the sustainable development of energy and its applications in hot desert climates.

Mot clé: Performance analysis, Electricity generation, Monitoring, Desert environment, Seasonal variations.

Numerical investigation of the effect of a magnetic field and magnetic nanofluid on heat transfer enhancement in microchannels

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Abstract

The objective of this research work is to conduct a numerical analysis of an active vortex generator in order to enhance heat transmission. The process involves applying a constant magnetic field generated by permanent magnets to a magnetic fluid that is flowing via a microchannel with varying width and nozzle levels. In this analysis, the flow is assumed to be laminar and two-dimensional. The fluid selected for the cooling process is a ferrofluid (Fe_3O_4-H_2O) used under conditions of low Reynolds numbers (100, 250), magnetic field intensities that vary in the range (0, 1400G) and fractions volumes equal to 0.5 and 1%. The configurations studied correspond to a source positioned at 7.5 mm and 15 mm respectively as well as two sources positioned simultaneously at 7.5 mm and 15 mm. The results indicate that the external magnetic field acts as a vortex generator that modifies the velocity distribution, improves fluid mixing and thus increases convective heat transfer. Heat transfer is better when the magnets are placed down, but pressure loss is greater when the magnets are placed up. Increasing the volume fraction does not modify the flow structure, however it improves heat transfer. It is also concluded that, in all cases, nanofluid recirculation occurs in the lower area of the microchannel and a larger nozzle diameter results in a larger and more visible recirculation area, which has a significant effect on the enhancement heat transfer in the microchannel.

Keywords: Ferrofluid , vortex , heat transfer , magnetic field.

Graphic abstract

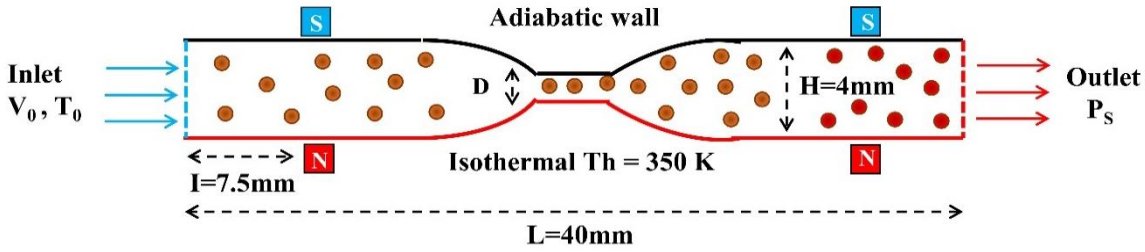

Fig.1. Channel configuration and boundary conditions.

Performance Study of Small-Scale Solar-Powered Autonomous Absorption Air-Conditioning System in a Low-Energy House under Batna (Algeria) Climate

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Abstract

Over the past decade, solar energy-driven air-conditioning systems have significantly evolved, as the need for cooling largely coincides with the availability of solar radiation. Among the available technologies in the market for cooling systems powered by thermal energy derived from a solar thermal system, absorption cooling systems have been recognized as the most advantageous due to their reliability and higher efficiency. This work focuses on the feasibility study and evaluates the functioning of a novel solar-driven autonomous absorption air-conditioning system coupled with a low-energy residential building under the climate of Batna, Algeria. A dynamic simulation model is developed using the TRNSYS-EES software. The proposed system uses solar thermal flat plate collectors to drive a small capacity single-effect LiBr/Water absorption chiller to meet the cooling demand of a typical low-energy residential building covering a total floor area of 120 m². A model of a 4.5 kW commercial absorption chiller has been modeled with EES software. The system's performance was dynamically modeled under Batna's weather conditions using METEONORM software. The validation results showed excellent agreement between the predictions and the experimental data ($R^2 > 0.988$) and proved the model ability to predict the performance of the chiller accurately. The analysis of dynamic results indicates that the proposed system and selected size enable the chiller to operate for a duration of up to 10 hours a day. This allowed ensuring a sufficient and continuous cold-water supply (between 8°C to 18°C) and maintaining the comfort temperature between 26°C to 28°C.

Keywords : Air-conditioning; Solar energy; Absorption cooling; Autonomous system; TRNSYS-EES.

Graphical summary

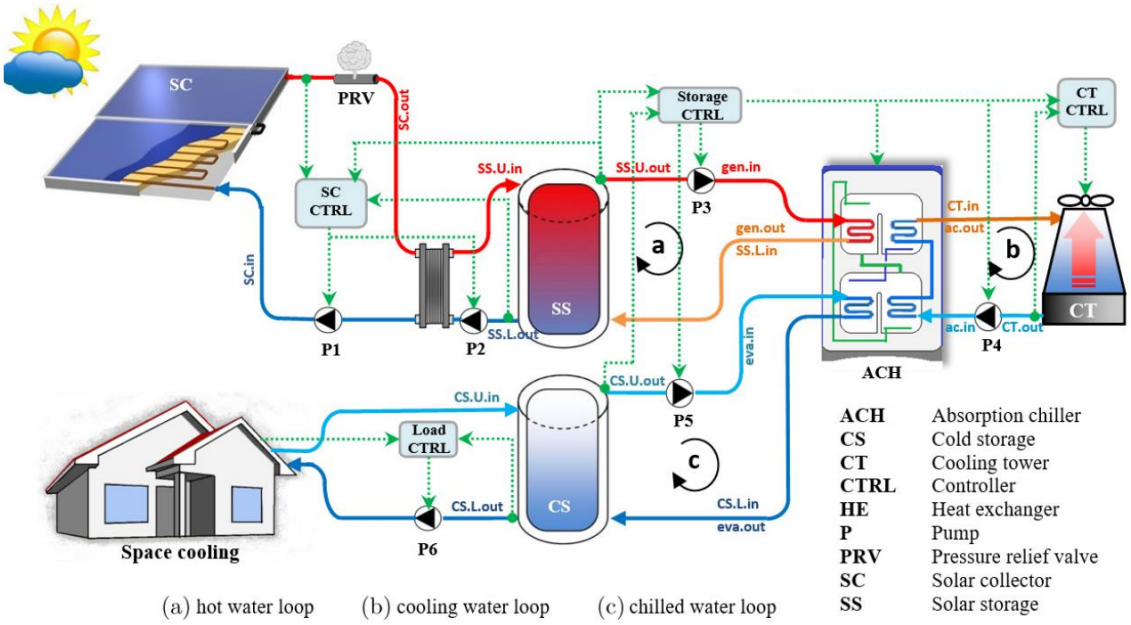

Fig.1. Schematic of autonomous solar absorption air-conditioning system.

A theoretical study on KGeCl3 for perovskite solar cells

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Abstract

The design of future combustion chambers increasingly relies on numerical simulations. Hybrid RANS/LES emerged as a method that offers a higher predictability for turbulent flames compared to Reynolds-averaged Navier-Stokes (RANS) approaches in reacting flows. This work describes an investigation based on RANS/LES methodology to analyze a premixed burner equipped with a bluff body. The turbulence-chemistry interaction scheme is treated using the Eddy Dissipation Concept (EDC) model in combination with a reduced skeletal mechanism for Hydrogen-air mixture, were investigated using the industrial code ANSYS-Fluent version 21. The 2D simulations were performed using a structured non-uniform grid refined in high gradient area. Experimental data from the reference, so-called Volvo combustor are used for validation of two baseline cases (Case I and II), described in Table 1.

Table 1: Considered parameter for the two cases, I and II.

Case	T_0 (K)	P_0 (atm)	m_0 (kg/s)	φ	v_0 (m/s)	Re_0
I	288	1.0	0.60	0.62	17.6	46.592
II	600	1.0	0.60	0.62	36.6	27.629

Keywords: premixed flame, hydrogen, bluff body, turbulence

Optimizing Photovoltaic Systems: Unveiling Dynamics in SP and TCT Configurations Under partial shading conditions and mismatch faults

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Résumé

Photovoltaic (PV) systems play a crucial role in the transition towards sustainable energy sources. This study extensively explores the performance of two key configurations—Series-Parallel (SP) and Total Cross-Tied (TCT)—within PV systems across a range of real-world conditions. The analysis focuses on two primary scenarios: Partial Shading Conditions (PSC) and Mismatch Problems arising from changing internal PV module resistance. The results reveal intriguing dynamics, showcasing the TCT configuration's effectiveness in mitigating the impact of PSC, while the SP configuration emerges as a robust choice for addressing mismatch problems. This research emphasizes the significance of selecting the right configuration to optimize the efficiency and resilience of PV systems, contributing significantly to the global shift towards greener energy solutions.

Mot clé : PV systems, Power optimization, TCT configuration, SP configuration, Partial Shading Conditions, Mismatch faults.

Résumé graphique

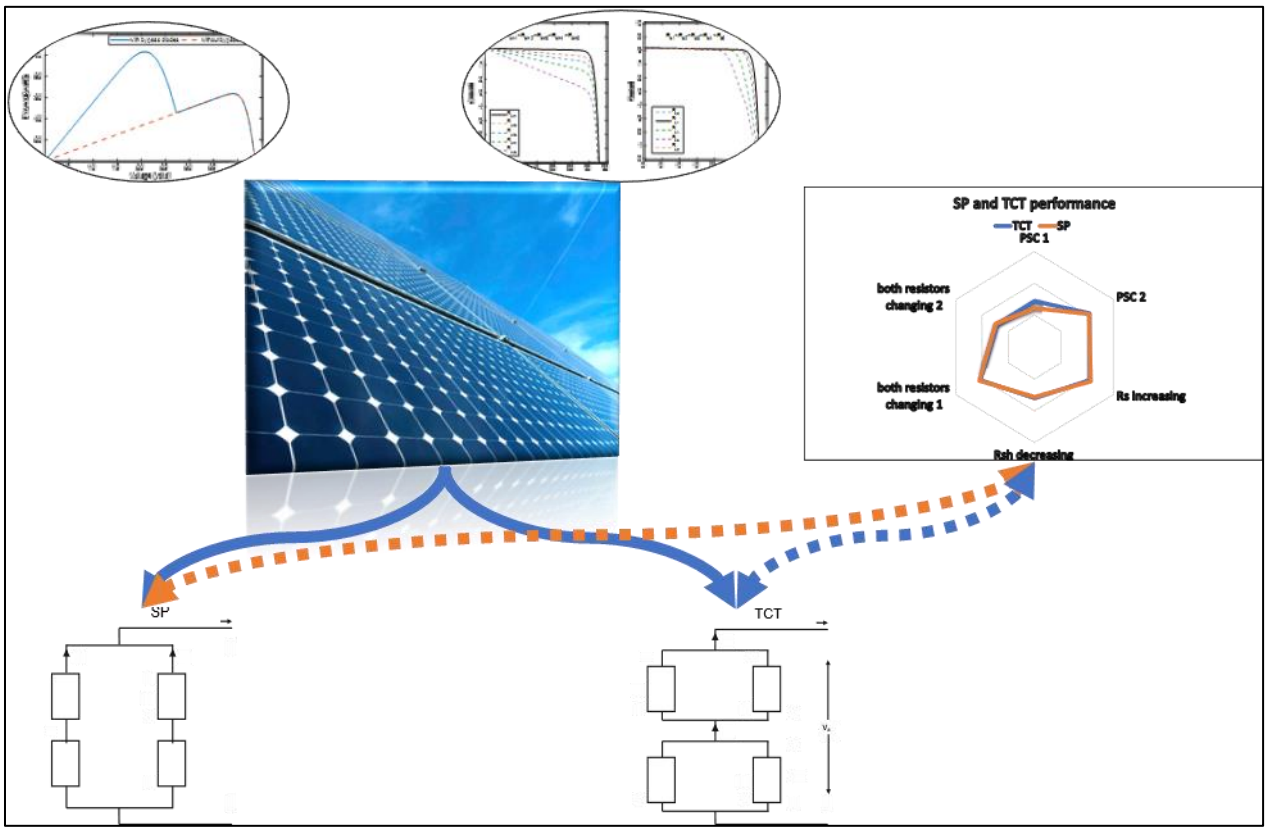

Fig.1.TCT and SP configurations performance under PSC and mismatch faults.

Dynamic modeling of an innovative PV-driven air-conditioning system for off-grid rural house

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Abstract

An innovative air conditioner cycle is presented; its operation has been detailed, investigated and dynamically modelled and simulated. The novelty of this novel air conditioner relies in its compression phase. The compression is accomplished through using the liquid piston principle. The compression work delivered by the liquid piston principle manifests within two cylinders referred to as transfer cylinders. During the refrigerant compression, an inert liquid circulates between the two transfer cylinders through a hydraulic pump. The liquid's piston motion oscillates between two transfer cylinders, each operating at distinct pressure levels. The cylinders that facilitate the movement of the liquid piston are connected to the rest of the cycle's components via pairs of valves. The connections of the cylinders are not fixed during the air conditioner's operation; rather, they switch between one cylinder being coupled with the evaporator while the other one is linked to the condenser, and vice versa. This distinctive alternating connection depends on the steps of the cycle.

The paper presents some of the main dynamic simulation results of the innovative hydraulic based air conditioner. The dynamic modeling is conducted using the OpenModelica environment. Through simulations, the efficiency of this novel air conditioner is demonstrated, specifically in the context of residential space cooling. The outcomes of the dynamic simulations not only align with the thermodynamic cycle description but also demonstrate that the new air conditioning cycle serves as a effective substitute for the existing systems available in the market.

Keywords: innovative Air conditioner, Liquid piston, Hydraulic compression, Dynamic modeling and simulation, OpenModelica, , Isentropic compression system.

Management of Power Integration in Hybrid Renewable Energy Systems for Microgrids

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Abstract

A hybrid microgrid is a combination of different generation and storage technologies that work together to provide a reliable and sustainable source of electricity to a community or area. It integrates renewable energy sources, such as solar photovoltaic panels and wind turbines, with conventional generators like diesel generators or gas turbines to provide backup power or supplementary generation when renewable sources are unavailable or insufficient. However, this makes power integration management in the main busbar difficult to control. This research proposes a solution for integrating multiple sources of electrical energy into a main grid.

The power management system solution includes the use of a micro Phasor Measurement Unit for data measurement and a control algorithm for efficient management of power generation, distribution, and consumption. The simulation model comprises photovoltaic panels, wind turbines, and an electrical load. The simulation results were validated using MATLAB software. According to the results, renewable energies are preferred when there is sufficient power to be injected. In cases where there is insufficient power, conventional sources are used to meet the demand for electricity consumption.

The Power Management System is a critical component in the efficient, reliable, and sustainable operation of microgrids. The integration of control algorithms optimizes energy generation, distribution, and consumption within the microgrid. Furthermore, it maximizes the integration of renewable energy sources and ensures a continuous power supply.

Keywords: Microgrid, PMU, Renewable energy, Power management, Energy distribution.

Obstacles to Optimal Function and Lifetime of Photovoltaic Systems in Desert Climates

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Abstract

Large-scale photovoltaic (PV) power plants for generating electricity from solar energy have become a prevalent new trend adopted by many countries. The Algerian desert appears optimal for PV deployment, making the region an appealing target for solar energy programs. The regions incorporate all necessary requirements for successful and sustainable investment, including extensive high insolation periods, specifically in the summer season. However, PV panel performance can be affected by many environmental parameters, significantly affecting power productivity, conversion efficiency, cost of energy, and operating lifetime.

This paper examines the current state of solar photovoltaic (PV) power plants in the Adrar region and the obstacles affecting optimal performance and lifespan of the PV systems. Based on observations across several plants - Adrar 20 MW, Zaouit Kounta 6MW, Kabertene 3MW and Reggan 5 MW - the harsh desert conditions pose significant challenges. High levels of solar radiation, extreme temperatures, and dust accumulation contribute to accelerated degradation of the crystalline silicon (c-Si) PV panels. This leads to issues like discoloration, cracking, hot spots, and sand obstructing cleaning truck access, especially in Reggan and Kabertene. Long-

term reliability is jeopardized as a result. To mitigate these problems and enable PV systems to operate successfully in desert environments, appropriate system design and maintenance strategies tailored for such conditions are imperative. With proper mitigation techniques, PV plants in deserts can realize their full potential as substantial contributors to the energy supply.

Key Word : Solar energy, PV systems, Algerian desert Climates, environmental factors.

Graphical summary :

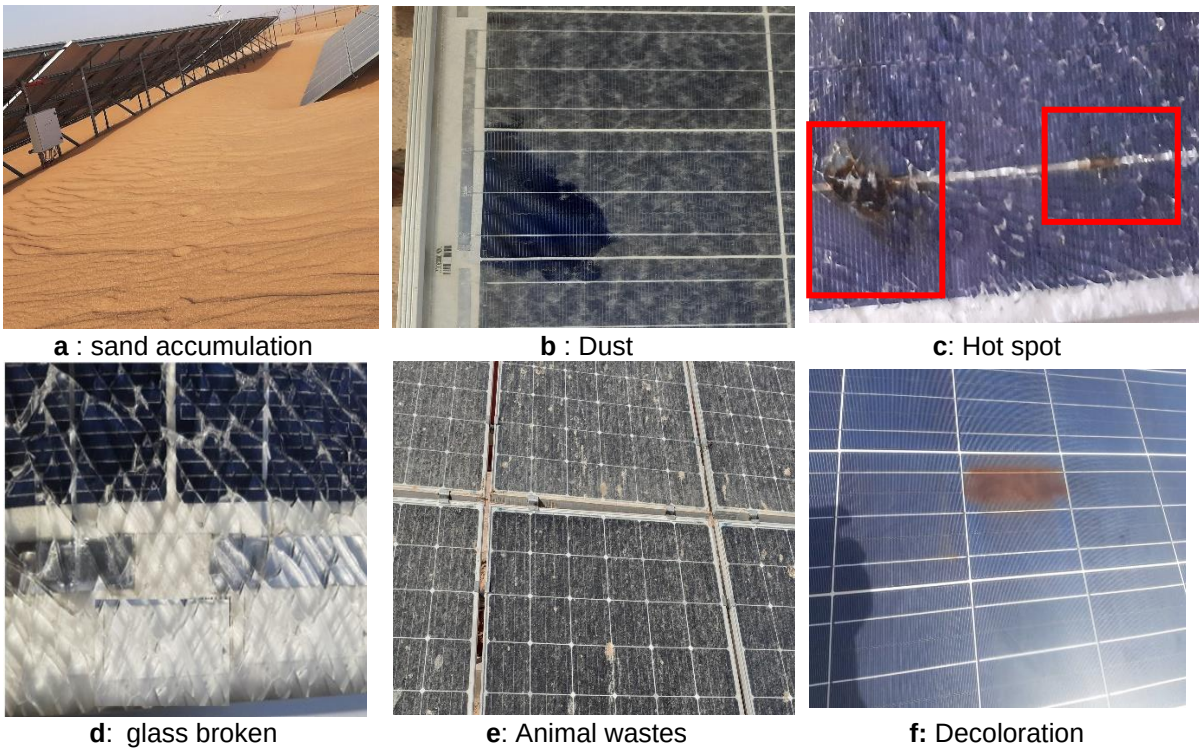

Fig.1. Degradation modes of tested PV panels in Adrar region.

A theoretical study on KGeCl3 for perovskite solar cells

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Abstract

In this theoretical study, we investigate the potential of $KGeCl_3$ as a lead-free perovskite active layer for perovskite solar cells. Using the generalized gradient approximation (GGA) within the wien2k package, we perform calculations of the structural, electronic, elastic, optic, and thermoelectric properties of $KGeCl_3$ in its cubic, tetragonal, and orthorhombic phases. Our results show that the tetragonal phase of $KGeCl_3$ has the lowest energy and is the most stable phase. We find that the electronic band structure of $KGeCl_3$ exhibits a direct band gap of 0.92 to 1.88 eV from cubic to the orthorhombic system, making it a promising material for use as a photovoltaic absorber. Furthermore, we calculate the elastic properties of $KGeCl_3$, indicating that it possesses suitable mechanical stability for practical applications. Additionally, we examine the optical properties and thermoelectric performance of $KGeCl_3$, highlighting its potential for use in thermoelectric devices. Overall, our study demonstrates the potential of $KGeCl_3$ as a promising alternative to lead-based perovskite materials for use in solar cells and other optoelectronic devices.

Keywords: $KGeCl_3$, PSCs, Lead-free based perovskite, first principle, thermoelectric

Effects of Experimental Parameters on the Structural and Mechanical Properties of NiO for Solar Energy Applications

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Abstract

This study investigates the impact of various experimental parameters on nickel oxide's (NiO) structural and mechanical properties, a material of growing interest for solar energy applications. Nickel oxide, known for its p-type semiconductor characteristics, offers potential in photovoltaic devices, electrochromic films, and as a photocatalyst. This research focuses on understanding how parameters such as synthesis method, substrate temperature, time of deposition, and particle size affect NiO's efficiency and stability in solar energy conversion.
Nickel oxide (NiO) is prepared using the spray pyrolysis (SP) method for a solution of nickel chloride dehydrate ($NiCl_2.6H_2O$) dissolved in distilled water on glass substrates. This technique allows for precise control over the film's thickness, morphology, and compositional uniformity, which are crucial for optimizing its performance in solar. The X-ray analytical study confirmed all the films (NiO) were crystallized in the cubic structure; the lattice parameter a is estimated to be 4.17 Å. The film is oriented along the (111) and (200) planes. Our results demonstrate that the experimental factors significantly influence the mechanical properties of the NiO layers. Higher precursor concentrations generally lead to thicker and denser films, resulting in increased hardness and reduced adhesion to the substrate. Changing the deposition temperature and time changes the NiO layers' crystallinity and grain size,

In summary, the mechanical and structural properties of pyrolysis-spray-prepared nickel oxide (NiO) can be finely adjusted by controlling the manufacturing process parameters. This allows the material to be optimized to meet the specific requirements of solar applications, such as photovoltaic cells and solar sensor coatings.

Keywords: NiO thin films, Spray pyrolysis, DRX, Strain and hardness

Etude de l'influence de la température et de l'ensoleillement sur le rendement photovoltaïque des panneaux solaires

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Résumé

Ce travail consiste à étudier l'influence de la température et de l'ensoleillement sur le rendement énergétique des cellules photovoltaïques, par le biais de tests expérimentaux et des mesures réalisées directement sur des panneaux solaires au sein de l'entreprise nationale « Condor ».

Une partie de ces tests a été réalisée au laboratoire où les résultats ont été fournis par le simulateur solaire FLASHER EL MBJ qui utilisait une valeur d'ensoleillement maximale et constante de 1000W/m^2 et des températures variables du panneau, tandis que l'autre partie des tests a été réalisée à l'extérieur en exposant le panneau solaire directement au soleil où les différentes valeurs d'ensoleillement et de température ambiante et même celle du panneau sont purement naturelles. Les mesures dans ce cas ont été fournies par l'analyseur « PROVA 210 PV » ainsi que d'autres appareils de mesure nécessaires.

Les résultats obtenus confirment que l'ensoleillement est le paramètre décideur de l'amélioration du rendement des cellules à condition que la température ambiante ne soit pas trop élevée ainsi que celle des panneaux, raison pour laquelle les systèmes de conversion photovoltaïque sont toujours munis de systèmes de refroidissement assurant ainsi un meilleur rendement énergétique. Ces résultats expliquent pourquoi l'Allemagne qui est un pays caractérisé par une température relativement faible (22-23°C), soit le pays le mieux classé mondialement en terme de rendement photovoltaïque vu sa position géographique sur la terre lui permettant de bénéficier d'un éclairement le plus élevé arrivant jusqu'à 1270 W/m2. Tandis que le Sahara qui est une zone caractérisée par une température élevée, son rendement reste un peu faible malgré qu'elle bénéficie d'un éclairement suffisamment élevé (vers 1000W/m2).

Mot clé : Mesure, Température, Ensoleillement, rendement photovoltaïque.

Étude de l'application des systèmes de rafraîchissement de l'air par dessiccation alimentés par l'énergie solaire à l'université Batna-1

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Résumé

Les systèmes de rafraîchissement de l'air par dessiccation, qui exploitent l'eau comme réfrigérant et peuvent être alimentés par des sources d'énergie renouvelables comme l'énergie solaire, offrent une alternative intéressante aux systèmes de refroidissement traditionnels. Cette étude évalue la faisabilité de l'installation d'une centrale de rafraîchissement de l'air par dessiccation alimentée par l'énergie solaire à l'Université Batna 1. Pour ce faire, nous avons collecté des données climatiques (température et humidité) pour le site de l'université sur le site web de la NASA, couvrant toute la période estivale. Nous avons également utilisé des modèles précédemment validés pour leur simulation précise du rayonnement solaire. En utilisant un modèle de simulation TRNSYS basé sur une centrale réelle située à LaSIE de l'Université de La Rochelle en France, nous avons appliqué les entrées des conditions climatiques et du potentiel solaire spécifiques au site de l'université. Notre analyse des données climatiques a révélé que les températures maximales moyennes pendant l'été atteignent 37°C, avec une humidité relative minimale moyenne tombant à 13%. Ces conditions se produisent généralement autour de 13h. De plus, notre étude a démontré que le potentiel solaire est suffisant pour alimenter la centrale pendant 6 heures continues. Dans ces conditions, le

coefficient de performance thermique de l'installation est estimé à 0,65, avec une capacité de refroidissement d'environ 18 kW. Cette recherche met en évidence le potentiel de ces systèmes dans les institutions académiques et les environnements similaires, ouvrant la voie à des solutions de refroidissement plus durables et efficaces.

Mot clé : dessiccation, rafraîchissement de l'air, humidification, TRNSYS, énergie solaire.

Résumé graphique

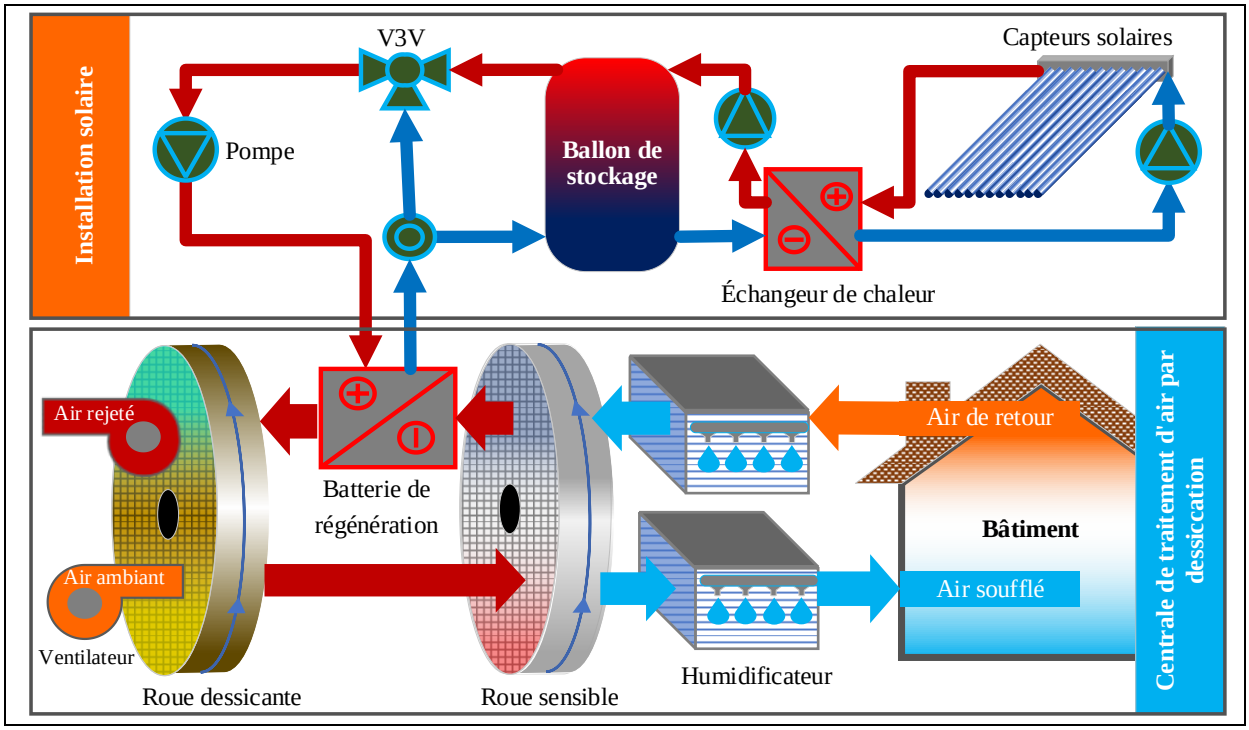

Fig.1. Centrale de rafraîchissement de l'air par dessiccation couplée à une installation solaire.

Étude du comportement thermohydrique d'un bâtiments dans différentes zones climatique en Algérie

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Résumé

Les matériaux utilisés dans l'enveloppe du bâtiment sont exposés pendant longtemps à diverses conditions difficiles. Les propriétés hygroscopiques de l'enveloppe du bâtiment affectent l'échange de vapeur d'eau entre le matériau hygroscopique et le climat intérieur et extérieur, provoquant des problèmes d'humidité tels que la condensation, la croissance de moisissures, une performance d'isolation thermique réduite entraînant une augmentation de la consommation d'énergie et la corrosion des matériaux de construction. Pour prévenir les problèmes d'humidité, il est important de comprendre le comportement thermique et hydrique des enveloppes des bâtiments dans chaque zone climatique. Le but de cette étude est d'évaluer les performances hygrothermiques des murs multicouches dans quatre régions d'Algérie à l'aide du programme de simulation WUFI, considéré comme l'un des programmes les plus avancés disponibles dans le commerce, ayant été validé par des tests sur le terrain à grande échelle sur de nombreuses années et qui se base sur le modèle de Künzel. Les données météo ont été issues du logiciel métronome. Trois types de murs ont été étudiés. Les critères d'évaluation choisis sont la teneur totale en eau et les besoins en chauffage et refroidissement. Les résultats montrent que le comportement thermohydraulique des bâtiments diffère d'un matériau à l'autre et d'un climat à l'autre. La nature de l'enduit joue un rôle important dans le contrôle de la pénétration de l'humidité au sein de la paroi. Son impact sur le comportement thermique reste faible. La nature du revêtement joue un rôle important dans le contrôle de la pénétration de l'humidité à

l'intérieur du mur. Les enduits de ciment et de chaux régulent considérablement l'humidité relative. L'enduit ralentit l'entrée de l'humidité dans les parties intermédiaires du mur.

Mots clés :

Simulation hygrothermique, consommation énergétiques du bâtiment, Transport de chaleur, d'air et d'humidité, matériau naturel, Climat

The impact of buoyancy and Lorenz forces on the melting rate in a large-scale gallium cavity

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Résumé

The research investigates heat transfer and melting behavior of gallium phase change material (PCM) in a large-scale cavity under magnetic field influence using a two-dimensional mathematical model and finite volume method simulation. Specific user-defined functions (UDFs) were included for magnetic fields ranging from 0 to 0.003 Tesla. The study discusses the interaction of natural convection, phase change, and magnetic forces based on obtained results, validated against experimental data. The magnetic field introduces Lorenz forces affecting gallium melting pace, hindering efficiency by 2% due to their impact on natural convection. Liquid fraction, total enthalpy, and average temperature evolution reveal the complex interplay of gravity, buoyancy, and magnetic forces during phase transition. Melting fraction and enthalpy show a linear trend until 90% liquefaction. Heat flux analysis indicates an initial rapid decrease followed by fluctuations attributed to buoyancy and magnetic forces.

Nusselt number trends reflect increased hindrance to heat transfer with higher magnetic flux, offering insights into the relationship between gallium melting, natural convection, and magnetic fields.

Mot clé : PCM (Gallium), Magnetic field, Natural convection, Large-scale cavity, Ansys fluent.

Résumé graphique

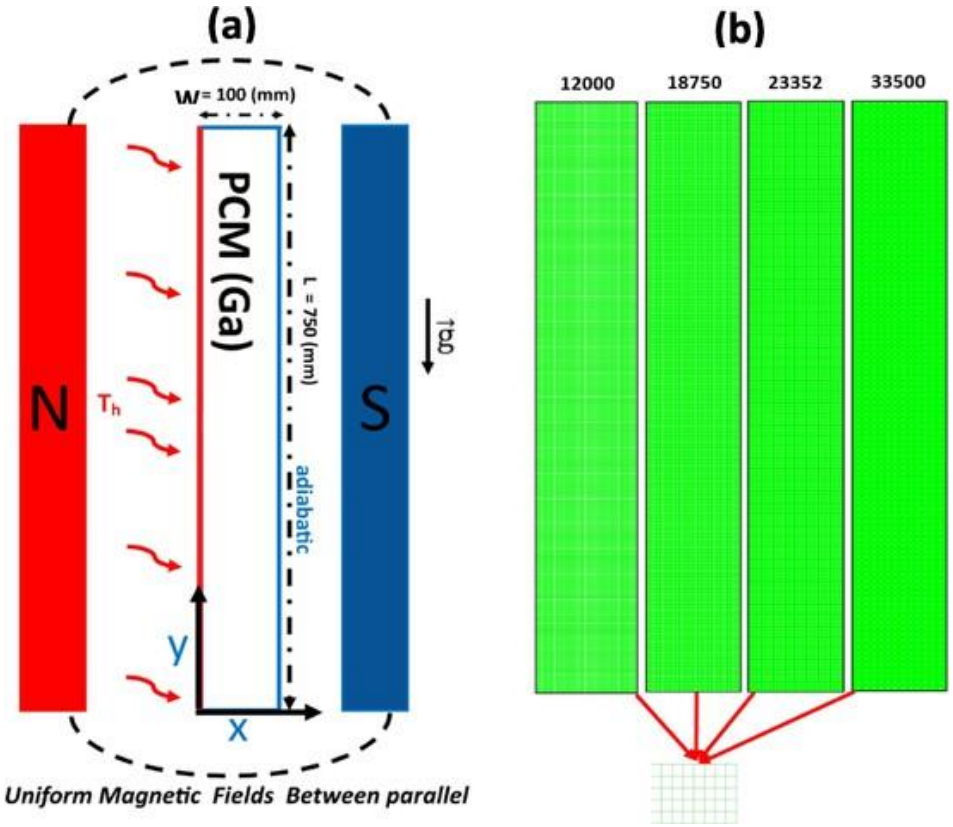

Fig.1. (a) schematic representation of the physical model of the heat storage unit with air heat exchanger and (b): Mesh view in the computational domain (PCM layer).

Etude et dimensionnement d'un système d'éclairage public photovoltaïque autonome

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Résumé

L'énergie photovoltaïque est la meilleure solution pour l'éclairage public, pour les zones isolées du réseau électrique et les lieux où son utilisation est chère ou difficile comme une meilleure solution pour réduire la facture énergétique. Le système complet de notre éclairage public autonome est très simple, facile et rapide à installer, mais la réalisation des installations photovoltaïques exigent une méthode de calcul et de dimensionnement de haute précision car l'installation sous dimensionnée reste une installation qui manque de fiabilité, tandis qu'une installation surdimensionnée va nous conduire à un coût plus élevé, donc le choix des éléments nécessite une attention particulière de la part des décideurs des projets solaire PV.
L'objectif de notre étude est d'installer un système photovoltaïque autonome, non raccordés aux réseaux électrique national, pour éclairer 7 poteaux à la willaya d'el Taref dans une zone semi-aride.
Mot clé : Système photovoltaïque, Dimensionnement, Eclairage public, Réseau autonome.

Résumé graphique

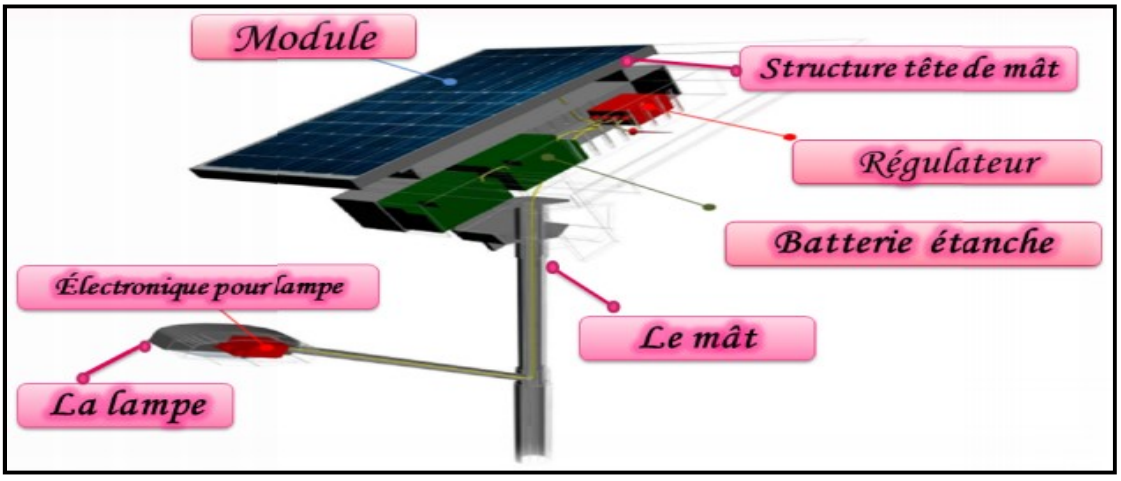

Fig.1. Conception du système d'éclairage public photovoltaïque autonome.

Utilisation des matériaux à changement de phase PCM dans l'isolation thermique des bâtiments

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Résumé

L'intégration de matériaux à changement de phase (PCM) dans le domaine de la construction représente une avancée significative pour l'amélioration de l'isolation thermique des bâtiments et la rationalisation de la consommation énergétique. Cette étude examine l'effet de l'incorporation de PCM dans deux modèles de briques sur les performances thermiques des structures. Les résultats démontrent que l'ajout de PCM renforce considérablement l'isolation thermique des bâtiments, offrant ainsi des gains substantiels en termes d'efficacité énergétique. Cette amélioration de l'isolation thermique se traduit par une réduction notable des pertes de chaleur et une meilleure régulation de la température intérieure.

Mot clé : Simulation numérique, Brique-PCM, Homogénéisation, RVE.

Résumé graphique

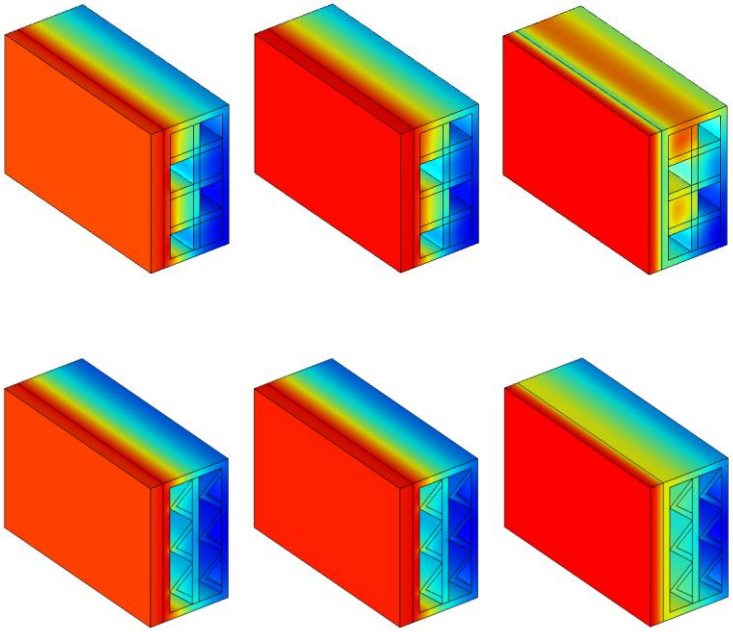

Fig.1. Distribution thermique dans les deux modèles Brique-PCM.

Impact du champ magnétique sur la convection naturelle d'un nanofluide dans une cavité avec des parois ondulées et des déflecteurs en forme de V.

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Résumé

Dans cette étude, nous nous sommes intéressés au transfert de chaleur par convection libre dans une cavité à parois ondulées, remplie d'un nanofluide Al_2O_3-eau et soumise à un champ magnétique. Dans cette cavité, on a intégré des déflecteurs au niveau de la paroi inférieure.
Pour cela, nous examiné en détail l'impact de plusieurs paramètres sur le transfert de chaleur et l'écoulement du nanofluide. Nous avons notamment étudié l'effet des nombres de Rayleigh et de Hartmann, l'influence de la fraction volumique des nanoparticules et l'installation des déflecteurs. Pour résoudre les différentes équations de transport, nous avons utilisé le logiciel de calcul Ansys Fluent basé sur la méthode des volumes finis en tenant en compte des forces de flottabilité représentées par l'approximation de Boussinesq. Les résultats obtenus mettent en évidence une amélioration du transfert de chaleur avec l'augmentation du nombre de Rayleigh et l'ajout de nanoparticules, tandis qu'une augmentation du nombre de Hartmann a un effet inverse du fait de l'influence du champ magnétique sur la convection libre. En outre, nos analyses suggèrent que l'installation de déflecteurs peut ne pas toujours favoriser le transfert thermique, ce qui souligne l'importance de considérer la géométrie spécifique de la cavité dans laquelle l'écoulement se produit. Les résultats obtenus peuvent aider dans l'optimisation de certains systèmes énergétiques exploitant les nanofluides en conditions de convection naturelle et en présence d'un champ magnétique.

Mots clés : Cavité, convection, MHD, CFD, nanofluide

Résumé graphique

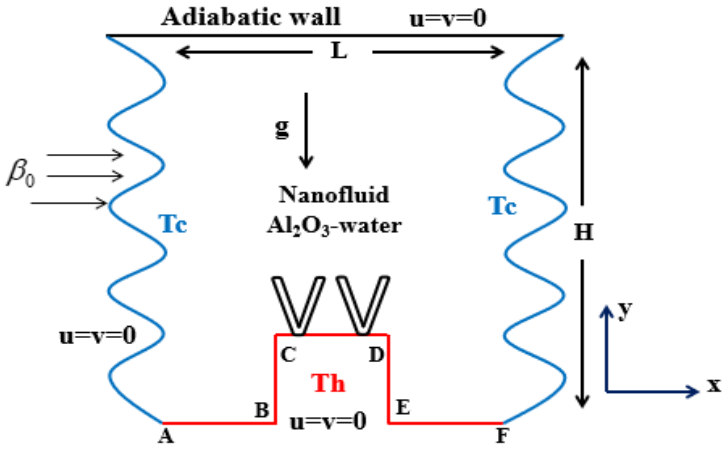

Fig.1. Configuration du cavité étudiée avec les conditions aux limites imposées.

Modélisation et Commande d'une Machine Double Alimentation Destinée à la Production de l'Énergie Electrique dans une Chaine Éolienne

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Résumé

Ce travail présente une technique de commande par mode glissant floue appliquée au système de conversion d'énergie éolienne équipée d'une génératrice asynchrone à double alimentation. Cette technique trouve sa plus forte justification aux problèmes d'incertitudes du modèle par l'utilisation d'une loi de commande non linéaire. L'objectif est d'appliquer cette commande pour contrôler l'échange des puissances active et réactive générées par la machine asynchrone avec le réseau en agissant sur les signaux rotoriques via un convertisseur bidirectionnel. Les résultats de simulations numériques obtenus montrent l'intérêt croissant d'une telle commande dans les systèmes électriques.

Mots clés génératrice asynchrone à double alimentation, mode glissant flou, commande vectorielle, contrôle des puissances.

Analysis of the Thermal-Mechanical Response of an Energy Geostructures (GEP) for heating and cooling

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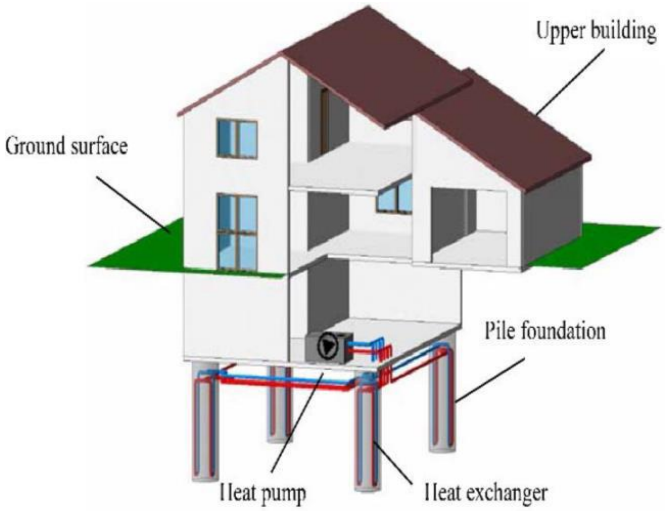
Abstract

The use of foundation structures (piles) coupled to a heat pump system, for heating and cooling needs. Commonly referred to as a geothermal energy pile (GEP) system, and can be achieved by field experiments or by numerical simulations (CFD) the latter of which has become an essential tool in GEP system conception and design. Computational fluid dynamics (CFD) analysis is used in this study to investigate and better understand how structural piles perform as geothermal heat exchanger. For this study, a bored energy pile of 15 m length and 400 mm diameter was installed , the analysis for an intermittent operation (8-hour operation, 48-hour stop) was considered. In addition, the thermomechanical coupling responses of energy piles in summer and winter conditions are also different and need to be explored separately. Taking these conditions into account, a transient 3D numerical model was established and solved by using the finite element method and a U-shaped exchanger energy pile was developed.

The results obtained are satisfactory and pave the way for further research to apply this energy variant to Algerian habitation.

Keywords: Geothermal energy pile , numerical simulations, thermomechanical, foundation.


Upper building
Ground surface
Pile foundation
Heat pump
Heat exchanger

Étude expérimentale des performances énergétiques d'un système solaire thermique, un capteur solaire thermique couplé à un échangeur de chaleur à eau avec ventilateur pour chauffer d'une pièce résidentielle.

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Résumé

Ce travail porte sur l'étude expérimentale des performances énergétiques d'un système solaire thermique utilisé pour répondre aux besoins de chauffage d'un local de volume 34,10m3 d'une cellule solaire implantée au campus de l'IGCMO à Oran. Le système solaire est composé d'un capteur solaire thermique plan d'une surface de 4,6m² couplé à un échangeur de chaleur à eau qui fonctionne comme un radiateur avec un ventilateur actif distribuant de l'air chaud dans la pièce où il a été installé, d'une capacité de chauffage de 5,9 KW et un débit d'air nominal 162,19 m3/h. Les performances thermiques ont été analysées expérimentalement. Les ailettes de l'échangeur de chaleur à air avec un ventilateur à flux transversal. Les influences de la vitesse d'écoulement d'air, de la température de soufflage, et de la température ambiante sur les performances thermiques des systèmes de chauffage ont été étudiées. Les résultats ont montré que le chauffage solaire par un échangeur de chaleur par ventilation avait de meilleures performances de chauffage. Lorsque le terminal fonctionnait dans des conditions radiantes entre 800 et 1000 w/m², avec l'augmentation de la température de l'eau à la sortie du capteur solaire thermique de 50,0 °C à 70,0 °C, la capacité radiante, de convection forcée et de chauffage a augmenté de 24,3 à 39,4 °C en revanche la température intérieure ambiante de 24,9 à 26,7 °C et de 25,5 à 27,2 °C, respectivement.

Les résultats obtenus confirment l'efficacité du système solaire thermique étudier capteur solaire thermique couplé avec un échangeur thermique avec un ventilateur actif en termes de chauffage des pièces des bâtiments.

Mot clé : Capteur solaire thermique ; Échangeur de chaleur ; Performance énergétique ; Confort.

Analyse technico-économique d'une station de pompage alimentée par énergie solaire photovoltaïque

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Résumé

Dans nos jours, beaucoup de populations dans les zones rurales des pays en voie de développement affrontent de grands problèmes dus au déficit en eau. Ces problèmes sont spécialement accentués dans les zones désertiques et semi-désertiques. Le déficit en eau est une question vitale pour les populations. L'amélioration des conditions de vie dans ces zones est liée à la recherche des solutions adéquates à ce problème. Le pompage solaire photovoltaïque (PV) représente la solution idéale pour l'approvisionnement en eau. La réalisation d'un système de pompage photovoltaïque autonome, fiable et à bon rendement, constitue une solution pratique et économique au problème du manque d'eau.
Notre étude traite plus particulièrement les éléments théoriques permettant de dimensionner les stations de pompage courantes et analyse la faisabilité et la rentabilité économique d'une station de pompage alimentée par énergie solaire photovoltaïque, laquelle est comparée avec une autre installation présentant les mêmes caractéristiques et fonctionnant à l'aide d'un groupe électrogène pour évaluer les coûts

Mot clé : Système photovoltaïque, Pompage solaire, Dimensionnement, Groupe électrogène, Site isolé, Coût.

Résumé graphique

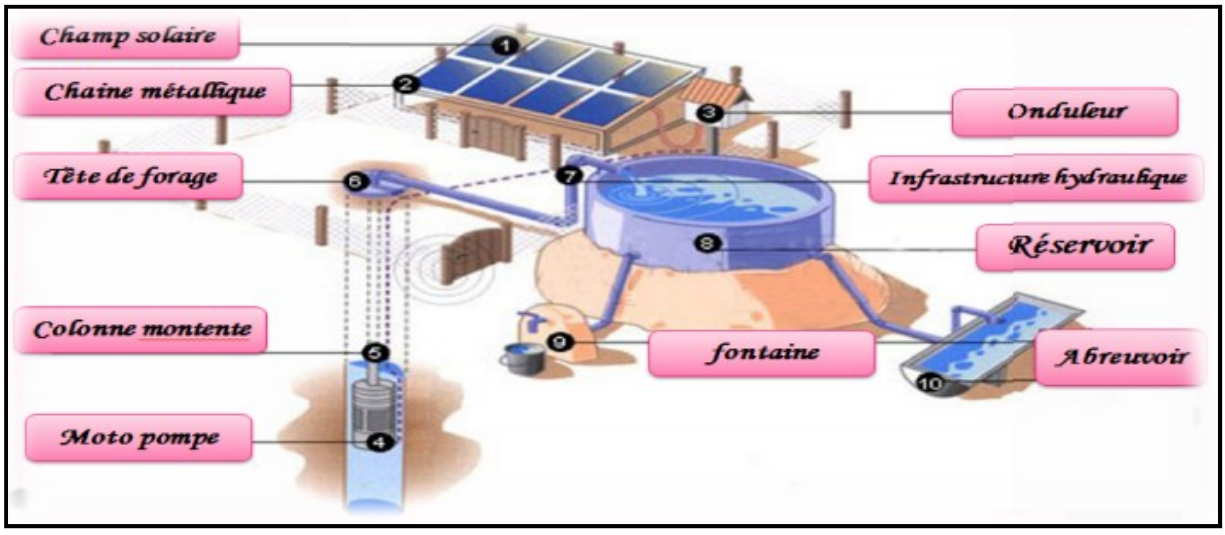

Fig.1. Configuration générale d'un système de pompage photovoltaïque.

Estimation du rayonnement solaire global incident sur un plan horizontal à l'aide de divers modèles mathématiques

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Résumé:

En Algérie, comme dans d'autres pays, le développement de l'énergie solaire est en partie diminué par un manque de données fiables sur l'ensoleillement. Le coût élevé des instruments de mesure et de stockage des données, associé à des moyens humains et matériels limités, restreint considérablement le nombre de stations de mesure pouvant être déployées. Face à cette contrainte, les chercheurs ont dû développer différents modèles mathématiques dans le but d'estimer les différentes composantes du rayonnement solaire.

Dans ce contexte, la présente étude se focalise sur l'estimation du rayonnement solaire global incident sur un plan horizontal à Ghardaïa. Elle compare les performances des modèles couramment utilisés dans la littérature, en les confrontant aux mesures réalisées sur site. Cette analyse comparative permet d'évaluer et de tirer des conclusions sur les performances respectives de ces différents modèles.

Mots Clés: *Rayonnement solaire, énergie solaire, modèles*

Résumé graphique

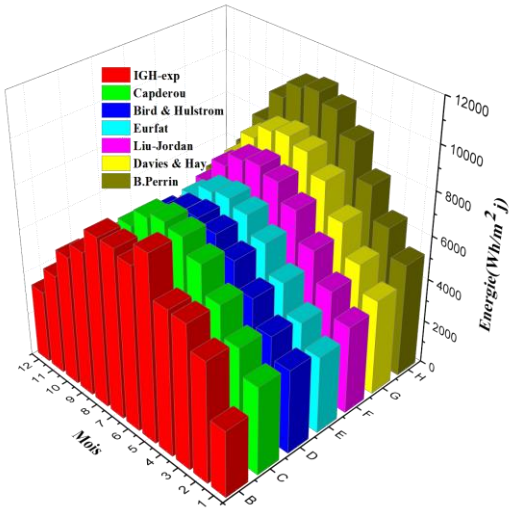

Figure 1 : Irradiation solaire mensuelle reçue sur une surface horizontale à Ghardaïa - Comparaison entre les prédictions des différents modèles avec les données mesurées.

Three-dimensional simulation of high temperature PEM fuel cells by using COMSOL Multiphysics

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Abstract

High-temperature polymer membrane fuel cells (HT-PEMFCs) technology is considered one of the most prominent technological developments in the field of energy, it is well suited to a wide range of applications, Whether mobile or stationary, in addition to their effective use in vehicles. This technology is distinguished by its ability to operate at high temperatures of up to 200°, compared to low-temperature membrane polymer fuel cells. In this work, a model of single-channel HT-PEMFCs in 3D was developed using COMSOL Multiphysics software. This model aims to understand and analyze the performance of this technology and precisely determine the factors that affect it, which contributes to developing and improving the performance and efficiency of these cells to meet the needs of different applications in the future.

The effect of inlet gas velocities (hydrogen and air) and polymer membrane conductivity on the performance of the high-temperature membrane polymer fuel cell was studied. The model was applied to a 3D membrane polymer fuel cell, where concentration profiles, current densities, Power density and polarization curves were monitored. The model includes the study of gas transport in gas flow channels at the anode and cathode, diffusion in the catalyst layers, water and hydronium ion transport in the polymer electrolyte and in the catalyst layers, and electric current transport in the solid phase. It has been shown that air is unable to provide enough oxygen to the cell for the electrochemical reaction to occur at lower flow velocities, resulting in lower flow rates. However, when airflow velocities are increased sufficiently, flow rates increase and cell performance improves.

Keywords: Three-dimensional simulation, COMSOL Multiphysics, HT-PEMFCs, Power density

Investigation on Combustion Characteristics and Emissions of Biogas mixtures with different oxidizers in Gas Turbine Combustion

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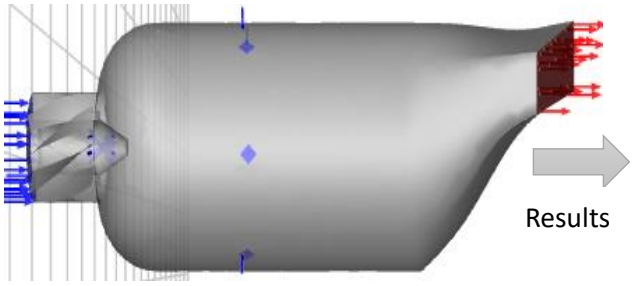
ABSTRACT

This research conducts numerical investigations to examine the combustion characteristics of an oxy-biogas mixture in a non-premixed swirling flame within a can-type gas turbine combustor. It specifically concentrates on analyzing the combustion behavior with different oxidizers and the variations in equivalence ratios. The biogas composition consists of 70% CH_4 and 30% CO_2 by volume, And the oxidizer consists of O_2 and CO_2 mixture at different concentrations. Equivalence ratios ranged from 0.1 to 0.8. Numerical simulations were conducted using a Computational Fluid Dynamics (CFD) code incorporating a PDF-Mixture Fraction model for a diffusion flame, a turbulent SST (k–omega) model, and a DO radiation model to simulate the combustion characteristics of the can type combustor across burner power levels ranging from 60 kW to 120 kW. Additionally, a grid independence study was performed. Moreover, the steady diffusion flamelet model is utilized to assess the impacts of varying oxidizer compositions, global equivalence ratio, and oxidizer flow rates on flame temperature and CO emissions. The findings suggest that using 100% oxygen as the oxidizer results in the highest temperatures near the fuel inlet due to efficient and rapid combustion in oxy-fuel systems. However, when a mixture of oxygen and carbon dioxide (O_2-CO_2) is used, temperatures decrease. The study concludes that the mixtures of 75% O_2 - 25% CO_2 and 50%

O_2 - 50% CO_2 at ϕ of 0.1, as well as 50% O_2 - 50% CO_2 at ϕ of 0.2, facilitate flame stabilization, ensure reasonable power output, and result in low CO emissions.

Keywords: Biogas, Oxy-fuel, Gas turbine, Temperature, Emission.

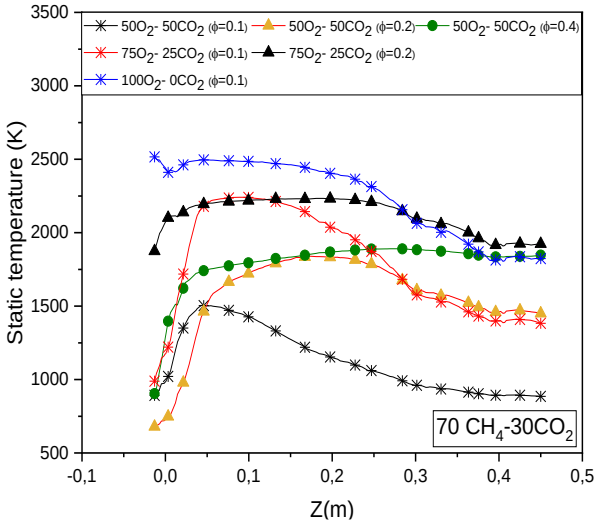
Graphical summary



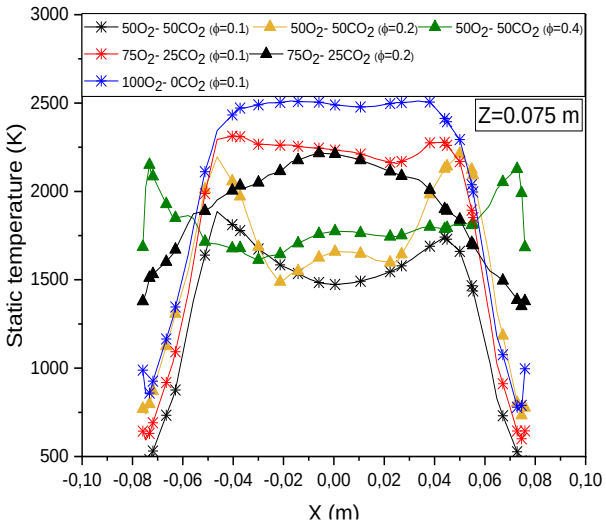
(a)

Oxidizer		Avearge Exit Temperature (K)	Average Exit CO mole fraction
50 O_2- 50 CO_2	(ϕ=0.1)	749.1404	0.001665
	(ϕ=0.2)	1134.63	0.001076
	(ϕ=0.4)	1810.906	0.000221
	(ϕ=0.8)	2454.427	0.052069
75 O_2- 25 CO_2	(ϕ=0.1)	1009.145	0.000065
	(ϕ=0.2)	1619.225	0.000128
	(ϕ=0.4)	2402.212	0.013037
100 O_2- 00 CO_2	(ϕ=0.1)	1342.499	0.000019
	(ϕ=0.2)	2131.529	0.000523

(b)



(c)



(d)

Fig.1. Summary about the oxy-biogas combustion process in can-type combustor, (a) Combustion chamber, (b) table of results, (c) Axial temperature profiles (d) Radial temperature profiles at different oxidizers and different equivalence ratio.

Harnessing Solar Power Resilience: Maximizing Photovoltaic Performance through Advanced Control Techniques

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Abstract

In their pursuit of the most efficient use of solar power, investigators are exploring new control algorithms to improve the performance of photovoltaic (PV) systems, such as Double Integral Sliding Mode Control (DISMC). This work investigates the effect of DISMC on PV system efficiency under different temperature and sunshine intensity scenarios using extensive simulation. The complex mechanisms that shape solar resilience in the face of environmental unpredictability are shown by each scenario. This study demonstrates how PV systems may optimize energy production while navigating natural variations by using DISMC MPPT, which strikes a compromise between stability and flexibility. The research highlights the potential of DISMC as a game-changing asset in the renewable energy sector and offers practical insights for improving the performance of PV systems in operation. This initiative goes beyond academic investigation and showcases a combination of computational accuracy and imaginative genius, pushing the boundaries of green energy exploration. Scientists, situated as agents of change, use DISMC to launch a sustainable energy revolution, foreseeing a world where clean, plentiful solar power powers everything. This research showcases the revolutionary capabilities of DISMC, leading the path towards a future that is less harmful to the environment and more sustainable.

Keywords: Different Radiance, Maximum Power Point Tracking (MPPT), Photovoltaic systems, Power Optimization, Double Integral Sliding Mode Control (DISMC), Temperature fluctuations.

Graphical summary

The components of the system as presented in Figure 1 include PV modules manufactured by Aavid Solar with the ASMS-180 M design, a DC-to-DC booster for regulation of voltage, a load, and a DISMC MPPT controller for adaptable solar power tuning.

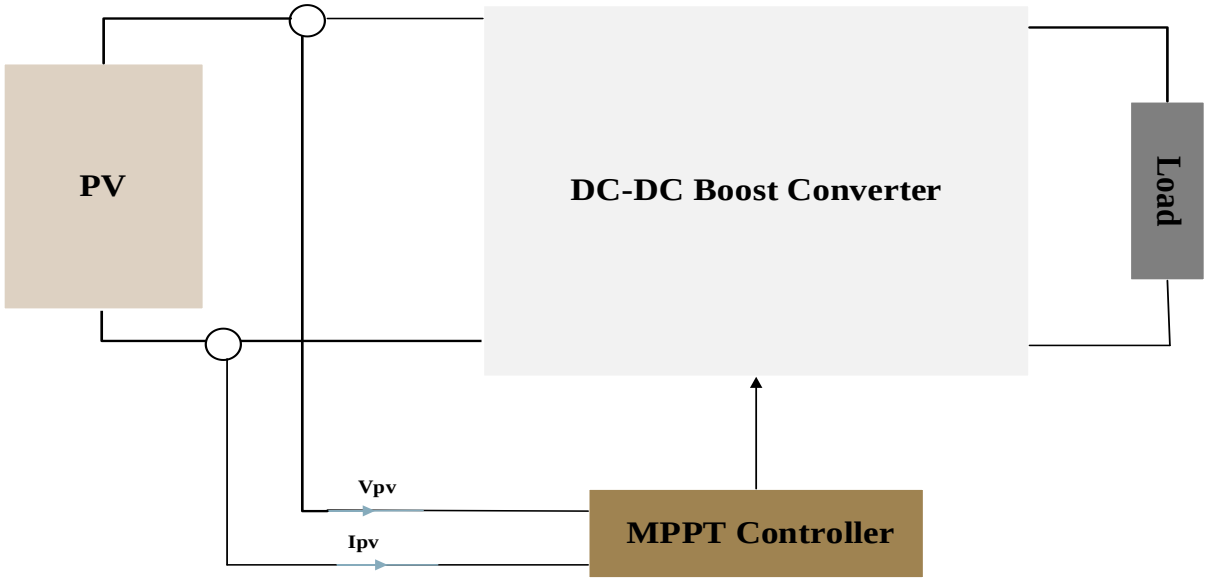

Fig.1. System configuration.

Enhancing Photovoltaic Systems: Revealing the Potential of Kalman Filter MPPT Technique in Changing Conditions

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Abstract

The tracking of maximum power points (MPPT) using a Kalman Filter (KF) is the subject of this investigation, which aims to optimize solar energy systems dynamically in various climatic circumstances. As essential parts of the sector of clean energy, solar energy generation systems may have their operating efficiencies affected by changes in temperature and irradiance. This research assesses the effectiveness of KF-based MPPT in responding to dynamic circumstances via careful investigation. The study elucidates the adaptability and dependability of KF in optimizing obtaining energy from PV arrays by investigating cases including both constant and changing levels of sunlight and temperature. The findings shed light on the promise of KF as a strong MPPT method to improve the efficiency and robustness of solar power plants in practical settings, which advances green power technology.

Keywords: Irradiance, temperature, Kalman Filter (KF), MPPT, solar energy.

Graphical summary

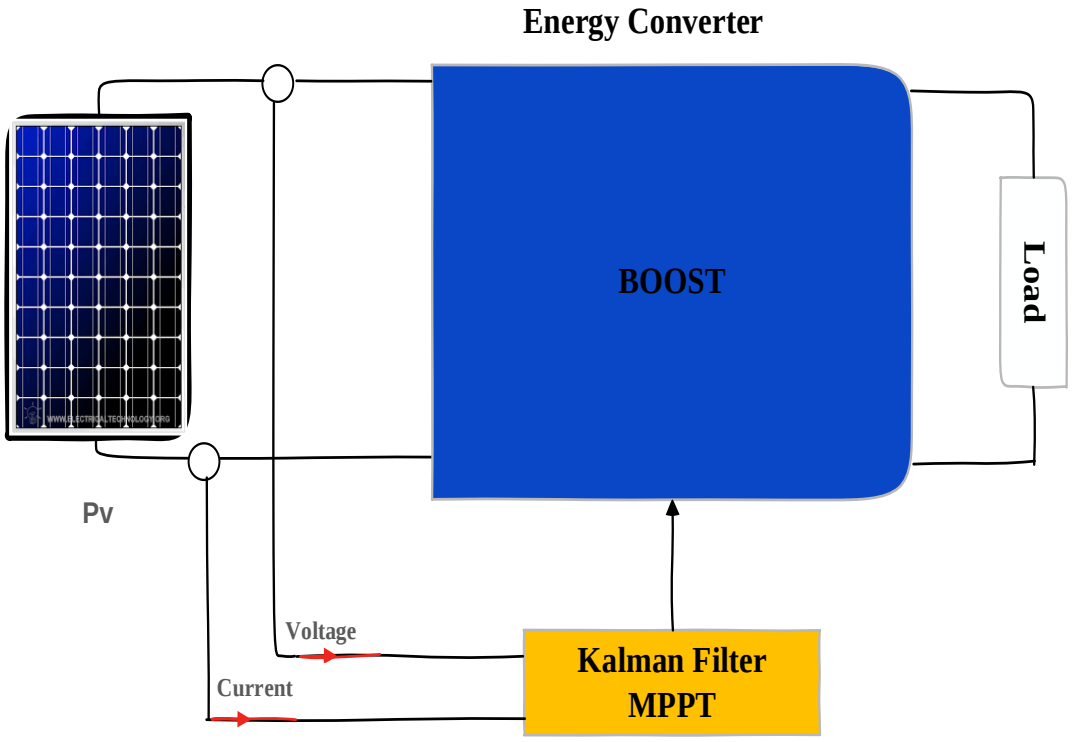

Fig.1. Setting up the system.

The effect of Nanofluids Characteristics on Improving Heat Exchange Inside an $AlSi_{10}mg$ Aluminum Alloy Cooler

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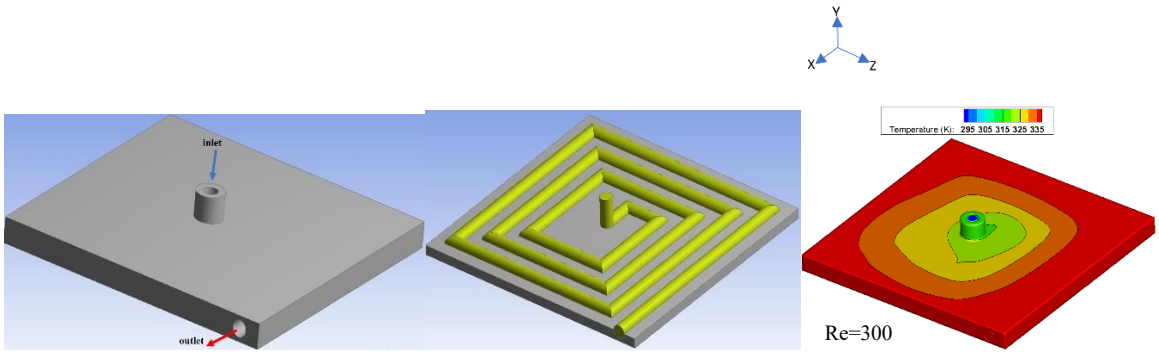
Abstract

This research aims to study the properties of nanofluids in improving the cooling of electronic components placed at the bottom of a cooler made of $AlSi_{10}mg$ aluminum alloy. This cooler contains a liquid inlet at the top and an outlet on the side, with dimensions of 40x40x3 mm^3. Two nanofluids (Al_2O_3-water; Cu-water) were chosen in addition to the water with a concentration of 5 percent of the nanoparticles. the governing equations were solved using the finite volume method. In this study, the Reynolds number (Re) range has been taken from 200 to 500. We assumed that the temperature of a liquid entering the cooler as constant and equal to 293 K for all liquids.

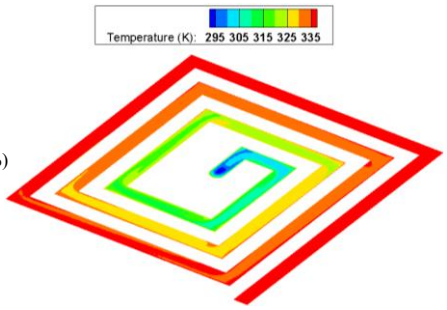
The obtained results from the simulation showed that the nanofluids contribute well to improving the electronic component temperature compared to the basic fluid (water). The results also indicate that increasing the Reynolds number with an increase in the concentration of nanoparticles in the basic fluid gives an increase in heat exchange.

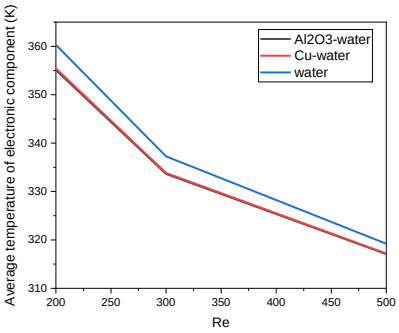
Key Words: Nanofluids, heat exchange, cooler, flow characteristics.

SOME RESULTS



The plane y=1.5mm
Liquid: cu-water (5%)
Re=300





Rayonnement solaire global synthétisé à partir de données expérimentales et théoriques

Hecini Amira[1], Chabane Foued[2], Toumi Chaima[1*], Aouissi Zouhair[1,*] , Moummi Noureddine[1,*], Boultif Soufounizia[1,*]

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Résumé

Selon le type de modèle, beaucoup fournissent une prévision suffisante pour estimer à la fois le rayonnement solaire direct et diffus ainsi que le rayonnement solaire global en établissant des équations mathématiques qui facilitent les calculs. En tenant compte des conditions météorologiques comme le ciel dégagé, l'étude menée en 2020 dans la région de Biskra par l'étude expérimentale Chabane vise à vérifier la validité du modèle de prévision des données estimées utilisé dans ce travail en étudiant le calcul de l'irradiation solaire globale sur la zone horizontale. Le modèle, connu sous le nom de modèle Kasten, se concentrait sur le type de ciel pour déterminer l'énergie solaire mondiale.

Mot clé : Modèle Kasten, rayonnement solaire, global, données expérimentales Chabane, diffus, direct.

Résumé graphique

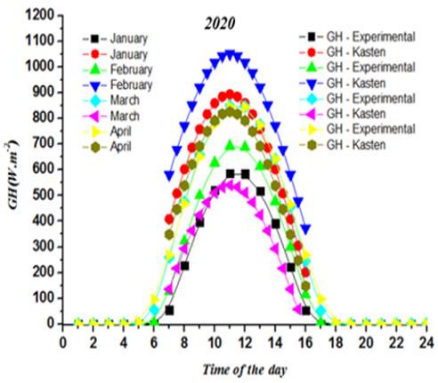

Fig. 1 Global solar irradiation from January to April month, according to experimental and theoretical data.

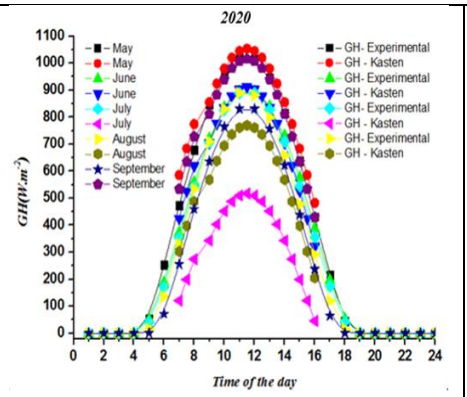

Fig. 2 Global solar irradiation from May to September month, according to experimental and theoretical data.

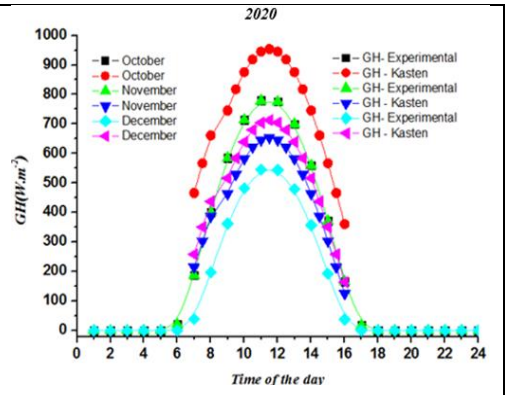

Fig. 3 Global solar irradiation from October to December month, according to experimental and theoretical data.

DETERMINATION DE LA DISTRIBUTION EN TAILLE DE L'AEROSOLS ATMOSPHÉRIUE.

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Résumé

L'estimation de l'éclairement solaire est nécessaire pour le dimensionnement des systèmes de conversions énergétiques En traversant l'atmosphère, le rayonnement subit différents atténuations. L'éclairement au niveau du sol dépend de la saison, elle peut diminuer de 1367 constante solaire jusqu'à 800 w/m^2 au niveau du sol en été. La plus importante de ces atténuations est celle due aux aérosols la diffusion plus l'absorption. Pour comprendre ce phénomène d'atténuation, il est nécessaire de connaître les propriétés microphysiques des particules c'est à dire la distribution en taille des aérosols.

Les aérosols sont considérés comme des particules sphériques de différents diamètres. La méthode qu'on utilise est la méthode itérative de régularisation, cette méthode consiste en l'utilisation de l'équation intégrale de FEDHOLME de première espèce, ou le noyau est la section efficace d'extinction Q_{ext} (r,m,λ) (CRAIG F. BOHREN 1983) multiplier par la distribution n(r) , r est le rayon de la particule m est l'indice de réfaction de l'ai et λ la longueur d'onde. Ce problème est connu en physique sous le nom des problèmes mal posés.

Dans ce premier travail, nous avons utilisé les données du code navy aerosol modele (C.R.ZEISS 1999). Les résultats sont encourageants, pour généraliser nous essayons d'utiliser les valeurs de l'épaisseur optique estimées à partir des mesures du photomètre CIMEL E 318 du réseau AERONET (Aerosol Robotic Network) dans le plan principal et dans le plan Almukantar de la station météorologique de Tamanrasset.

Mot clé: éclairement solaire, distribution en taille, indice de réfraction, équations intégrales.

Numerical Study of the Impacts of the Magnetic Field Orientation and Cavity Inclination on the Rayleigh-Bénard Convection

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Abstract

This study employs numerical simulations to systematically investigate the influence of various parameters on Rayleigh-Bénard convection in nanofluids. The finite volume method implemented in MATLAB is utilized to analyze the impacts of Hartmann number, cavity inclination angle, magnetic field orientation angle, and copper nanoparticle volume fraction. The resulting flow structures, temperature distributions, and heat transfer rates are comprehensively assessed through the analysis of average Nusselt numbers, streamlines, isotherms, and velocity and temperature profiles. The findings reveal that each parameter exerts a distinct and quantifiable influence on the flow characteristics and heat transfer behavior within the nanofluid.

keywords: Convection; Magnetohydrodynamic; Nanofluids; Rayleigh-Bénard; SIMPLER

Analysis of Magneto-Hydrothermal Characteristics in a Horizontal Concentric Annulus with a Ternary Hybrid Nanofluid: A Numerical Study

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Résumé

Transport of Heat transfer phenomena related to magneto-hydrothermal for laminar flow forced convection have recently has become an important area of study because of their multi-thermal industrial applications such as electronics cooling, solar collectors, thermal exchangers, biomedical, and others. The current study aims to analyze the magneto-hydrothermal induced by imposed uniform heat flux at the external cylinder for laminar flow with the presence of three types of nanoparticles (Fe_2O_3, CNT, and Gr) and shapes (spherical, cylindrical, and platelet) inside a horizontal concentric annulus. The governing equations are solved using ANSYS Fluent software. Single-phase approach and thermal equilibrium are adopted. The originality of this study is to investigate the influence of magnetic field heat transfer characteristics. The effects of different Hartman numbers (Ha) for one Reynolds number (Re) and single volume fraction (ϕ) on the Nusselt number, skin friction coefficient, and pressure drop are comprehensive detail. The results showed a dependence of the ternary hybrid nanofluid flow behavior on the strength of the magnetic field. Stronger magnetic fields intensify convective heat transfer, fluid resistance, and energy losses in magnetohydrodynamic flows.

Mot clé : Ternary hybrid nanofluid, laminar, forced, magnetic field, annulus.

Exploring new baffles positions within a duct for solar air collection: a numerical and experimental study

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Abstract

The aim of this study is to conduct a numerical and experimental investigation of the process of heat transfer inside a solar air collector by adding four baffles of different positions. In this study, new angles of inclination for obstacles were selected as follows: β=90°, β=45°, β=135°, β=90° respectively. In order to improve the heat transfer inside the collector, the position of the rectangular obstacles inside the channel was taken into consideration, based on previous studies showing that not only the number of baffles that affect the heat transfer, but the positioning of it greatly affects the transfer process as well, the study was conducted in the field of Reynolds numbers from Re=1282 to Re=7927. The ANSYS Fluent 18.1 software was used in the numerical study, where the boundary conditions were taken from the experimental investigation in Biskra , Algeria. In this work, many characteristics of this transformer were compared with the numerical and experimental methods, such as the heat transfer coefficient and the thermal efficiency. It was found that there is a great convergence between the experimental and the numerical results. The results gives a closer picture of the effect of mass flow rates on the heat transfer process from the absorber to the air, by analyzing the average temperature of the passing air and the absorption plate, the difference in temperature between the inlet and outlet, heat transfer coefficient and thermal efficiency. The results also showed a small pressure drop compared with many of the previously studied types of baffles. Finally, it was concluded that the factors that increase the heat transfer of the solar air collector are the increase in mass flow rate of air, addition of baffles, and heat of the absorber plate.

Keywords: Solar air collector, baffles, mass flow, heat transfer coefficient, ANSYS Fluent.

Graphical summary

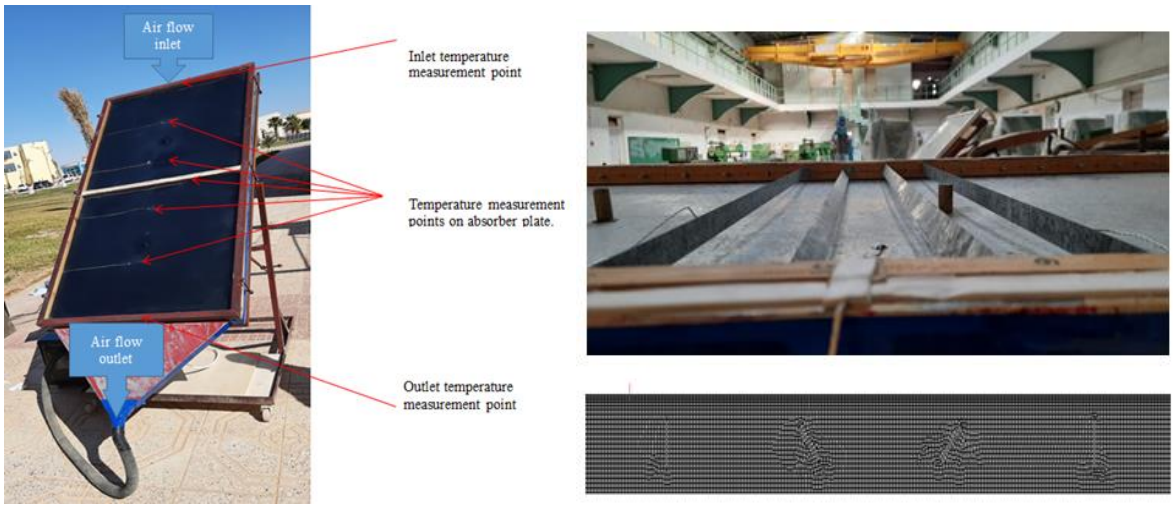

Fig.1. Configuration showing the studied solar collector, in addition to an example of one case of obstacles.

Aerodynamic performance improvement of a wind turbine airfoil using passive flow control technique

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Abstract

In this study, a passive flow control technique using a leading-edge micro-cylinder is applied to improve the aerodynamic performance of the NREL S809 wind turbine profile. The unsteady Reynolds-averaged Navier-Stokes equations (URANS) that govern the fluid flow around the profile are solved in a two-dimensional domain using the ANSYS Fluent CFD software. The simulations are conducted at a Reynolds number of 10^6, and the turbulence is simulated using the $SST - k\omega$ model. The simulation results are first validated by comparison with published data from existing literature. Then, the effect of the rod on the aerodynamic performance of the profile is investigated. This study is carried out for rods of different diameters and different locations. The results show that the rod reduces the separation zone and improves the aerodynamic characteristics of the profile.

Keywords: Wind turbine, Passive flow control, Rod, S809 airfoil, CFD.

Graphical abstract

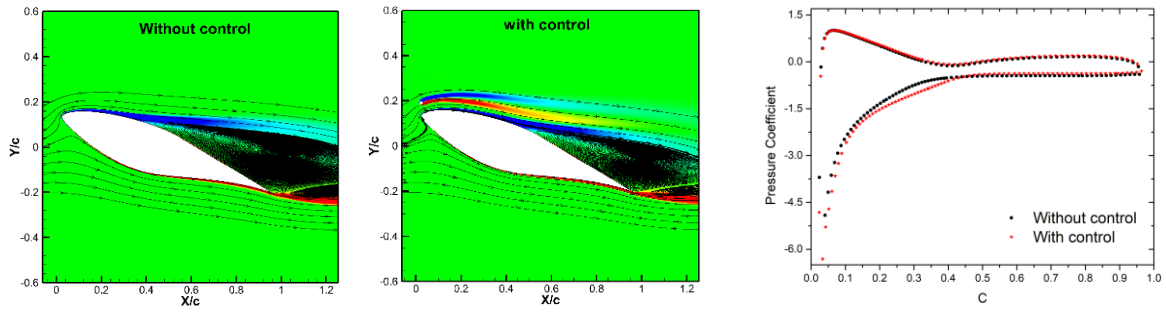

Fig.1. Streamline and contours of the Z-vorticity around the S809 airfoil without (a) and with control (b) and pressure coefficient distribution (c) at $AOA = 20°$ and $Re = 10^6$.

Fabrication des quaternaires de $CuInGaSe_2$ par la méthode Co-évaporation

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Abstract

Des matériaux quaternaires $CuInGaSe_2$ (CIGS) ont été préparés par la méthode co-évaporation. Leur étude structurale a permis de mettre en évidence l'existence de la phase chalcopyrite. L'exploitation de ces matériaux en co-évaporées a montré le rôle important joué par les joints de grains. Ainsi, le modèle de Mott a été vérifié à basse température contrairement à l'émission thermoïonique qui est prépondérante à haute température.

L'étude de l'absorption optique a confirmé que ces matériaux sont bien adaptés à la conversion photovoltaïque.

Keys words: $CuInGaSe_2$, couche mince, proprieties électriques, co-èvaporation,absorption optique. .

Power Control of Grid-Connected DFIG-Based Wind Turbine System

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Abstract

DFIG-Based wind turbine system is mostly connected to a power grid with high scale. Therefore, a reliable driving of that system is vital for the stability and the reliability of the power grid. That requires a robust driving of the DFIG. Among existing driving methods, it is cited power control one due its advantages related to the grid requirements. That is guaranteed in part via a robust control method of stator powers. On this work the control is based on high-gain sliding mode control (HG-SMC). It does not require the estimation of DFIG flux. The interesting point of the proposed strategy consist on the elimination of rotor's current sensor, which leads to lower cost and failure rate in the drive system. The proposed control scheme is verified by experiments on a 7.5 kW DFIG power prototype. The control system robustness and performance are assessed in the presence of simulated parameter variations. The Figure 1 shows a brief description of grid-connected DFIG-Based wind turbine. The meaning of the notations is: τ: represent a torque. P and Q: represent the active and reactive powers respectively. v: represent a voltage. i: is the current. d,q: direct and quadrature components, respectively. r,s: rotor and stator components, respectively. ref: represents a reference component. a, b, c: given for three-phase components. φ: given for flux. L: to design inductances. R: to design resistances. G, K: positive gains. $\bar{x}$: the nominal value of x.

At time kT (T represents the sampling time and k is an integer value), the components of the rotor voltage references are calculated using HG-SMC and are given by:

$$\begin{cases} v_{dr}(kT) = \begin{pmatrix} K\ sign(S_Q(kT))+ \\ +GS_Q(kT) + \overline{Y}_1(kT) \end{pmatrix} \Big/ (\bar{a}_4 v_{qs}(kT)) \\ v_{qr}(kT) = \begin{pmatrix} K\ sign(S_P(kT))+ \\ +GS_P(kT) + \overline{Y}_2(kT) \end{pmatrix} \Big/ (\bar{a}_4 v_{qs}(kT)) \end{cases}$$

$$a_1 = \left(\frac{1}{\sigma T_s} + \frac{1}{\sigma T_r}\right), \quad a_2 = \frac{1}{\sigma L_r T_s}, \quad a_3 = \frac{1}{\sigma L_r}, \quad a_4 = \frac{(1-\sigma)}{\sigma L_m};$$

and $\sigma = 1 - \frac{L_m^2}{L_s L_r}$ is the dispersion coefficient.

$$\begin{cases} \overline{Y}_1(kT) = -\bar{a}_1 i_{ds}(kT) v_{qs}(kT) + \omega_s i_{qs}(kT) v_{qs}(kT) + \\ \quad + \bar{a}_2 \overline{\varphi}_{ds} v_{qs}(kT) - \bar{a}_3 \omega \overline{\varphi}_{qs} v_{qs}(kT) - \dot{Q}_{ref}(kT) \\ \overline{Y}_2(kT) = -\omega_s i_{ds}(kT) v_{qs}(kT) - \bar{a}_1 i_{qs}(kT) v_{qs}(kT) + \\ \quad + \bar{a}_2 \overline{\varphi}_{qs} v_{qs}(kT) + \bar{a}_3 \omega \overline{\varphi}_{ds} v_{qs}(kT) + \bar{a}_3 v_{qs}(kT)^2 + \\ \quad - \dot{P}_{ref}(kT) \\ S_P(kT) = P_s(kT) - P_{ref}(kT) \\ S_Q(kT) = Q_s(kT) - Q_{ref}(kT) \\ \dot{P}_{ref}(kT) = \frac{P_{ref}(kT) - P_{ref}(kT-T)}{T} \\ \dot{Q}_{ref}(kT) = \frac{Q_{ref}(kT) - Q_{ref}(kT-T)}{T} \end{cases}$$

Keywords:
Doubly fed induction generator (DFIG); Reduced switching frequency; Real-time implementation; High-gain sliding mode control (HG-SMC); Unknown flux and rotor currents.

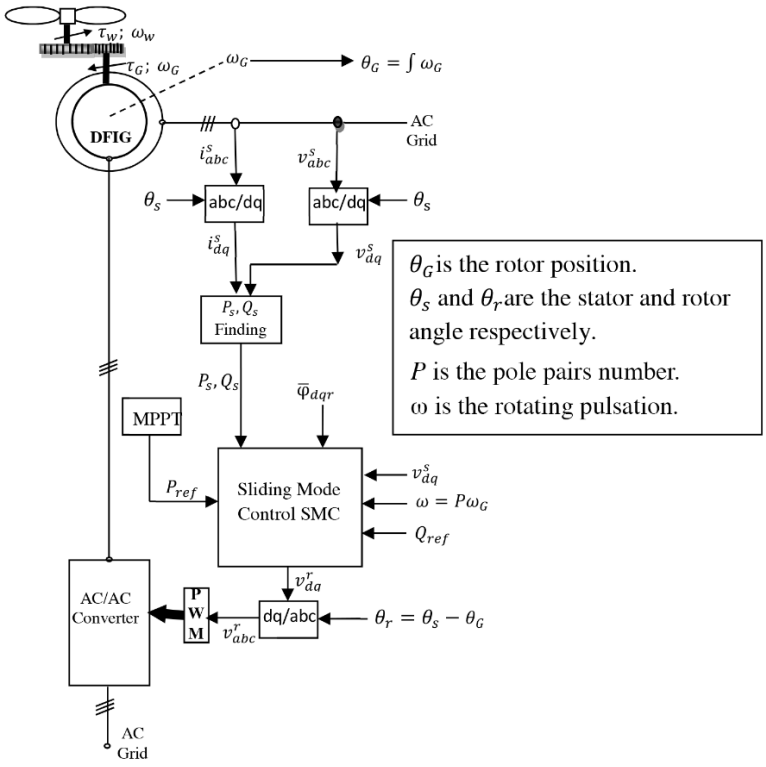

Figure 1. Brief presentation of the studied system.

Synchronization of DFIG-Based Wind Energy Conversion System Connected to a Disturbed Power Grid

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Abstract

The task related to the start-up of a DFIG to a power grid is considered as vital for the operating of the linked wind energy conversion system. The last one depends to the synchronization of the DFIG to the power grid. That subject grew special attention recently in grid codes in order to ensure the operating under voltages disturbances of the power grid. The main object of this requirement is to ameliorate the grid stability from the frequency point of view and increase the integration ratio of wind energy conversion systems. The viability of that requirement depends heavily on that of the synchronization procedure. The last has not been investigated sufficiently under disturbed grid voltages. The methods proposed in the literature are limited to the case of harmonical or unbalanced grid voltages. The method proposed by the authors are valid for all the cases of the grid disturbances. The types of the voltage disturbances including harmonics, unbalance, flickers, inter-harmonics, over-voltages and dips. These disturbances could occur simultaneity or alone. the present paper introduces a smooth grid synchronization strategy with HVRT capability. The feasibility of the proposed method is validated analytically and experimental results.

The Figure 1 gives a brief presentation of the proposed method. The associated timing flowchart is given as in Figure 2. The value of the inserted resistance R and the time of the transition conditions are defined in such to get a smooth start-up. This is based on the model of the DFIG and its nominal parameters, and taking into account the bounds of the currents and the grid voltages.

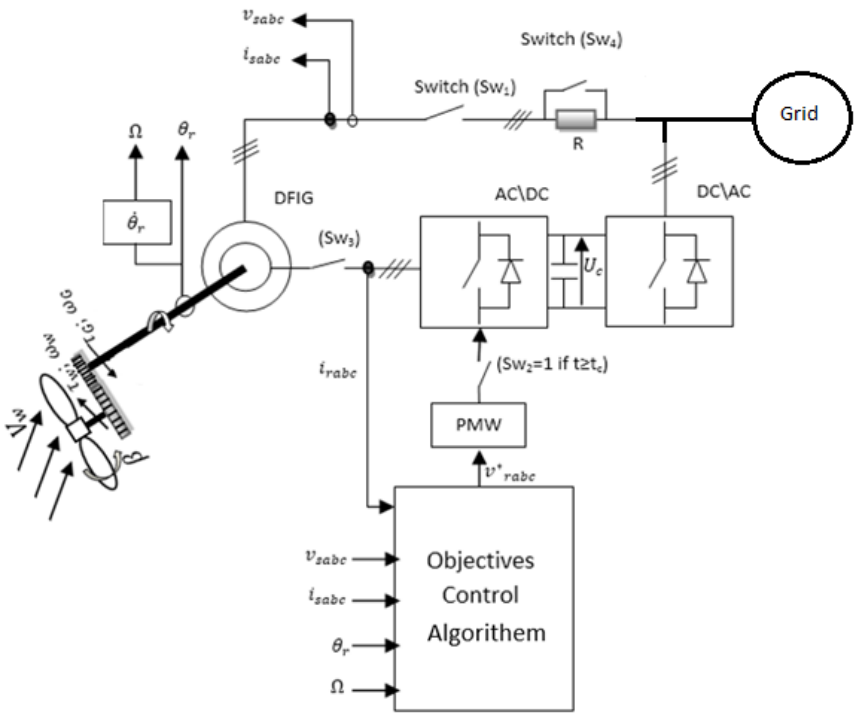

Figure 1. Brief presentation of the proposed start-up method.

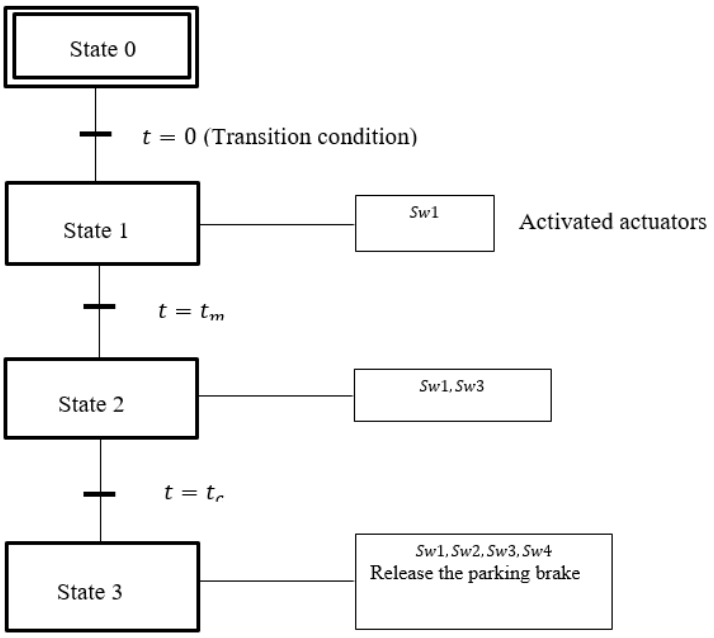

Figure 2. timing flowchart.

Realization of an IoT System for Autonomous Monitoring of Wind Turbine Installations

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Abstract

This research project presents the design and implementation of an autonomous and cost-effective IoT system dedicated to the monitoring of wind turbine installations. The proposed architecture is based on four main layers: sensors, network, management, and application.

The sensor layer comprises an STM32WB55 microcontroller integrating various sensors: an accelerometer, an MPU6050 gyroscope, a microphone, as well as temperature, wind speed and direction sensors. This heterogeneous set of sensors enables the monitoring of critical parameters related to the operation of wind turbines. Specifically, the accelerometer measures structural vibrations, which are indicators of the overall machine condition. The microphone detects abnormal sounds, potentially revealing impacts or collisions. The temperature sensors measure internal and external conditions influencing performance. The gyroscope accurately determines the blade pitch angle, their optimal alignment with respect to wind direction, and their rotational speed. Finally, the anemometer measures wind speed and direction, which are essential parameters for proper blade orientation.

The network layer utilizes a Raspberry Pi 4 as a Bluetooth Low Energy (BLE) gateway, enabling bidirectional wireless communication between the sensor nodes and the server. This gateway collects data from the various sensors and securely forwards it to the upper layer.

The management layer integrates the ThingsBoard IoT platform for data visualization and an anomaly detection model based on machine learning. This model continuously analyzes the data streams and automatically identifies any abnormal behavior that could indicate a malfunction or premature component degradation.

The application layer comprises a dedicated web user interface for wind farm operators and managers. This centralized dashboard displays real-time monitoring data, overall turbine status, and alerts generated by the anomaly detection system.

Extensive testing has validated the end-to-end operation of this solution. At the gateway level, successful reception of multi-sensor data, establishment of a reliable BLE connection, and data forwarding to ThingsBoard via MQTT have been verified.

A major advantage of this system lies in its complete energy autonomy achieved through ambient RF energy harvesting. This feature significantly increases the deployed lifetime, reduces maintenance costs, and enables simplified deployment without the need for power cabling. This modular and cost-effective IoT solution integrates a heterogeneous sensor network covering all relevant dimensions of wind turbine monitoring. Coupled with machine learning, its intelligent anomaly detection capability makes it a powerful tool for optimizing production, ensuring safety, and extending the lifetime of wind installations.

Mot clé : Condition Monitoring, Wind Turbines, Wireless Sensor, Autonomous Node, IoT, Machine Learning, Deep Learning, ThingsBoard.

Graphical Abstract

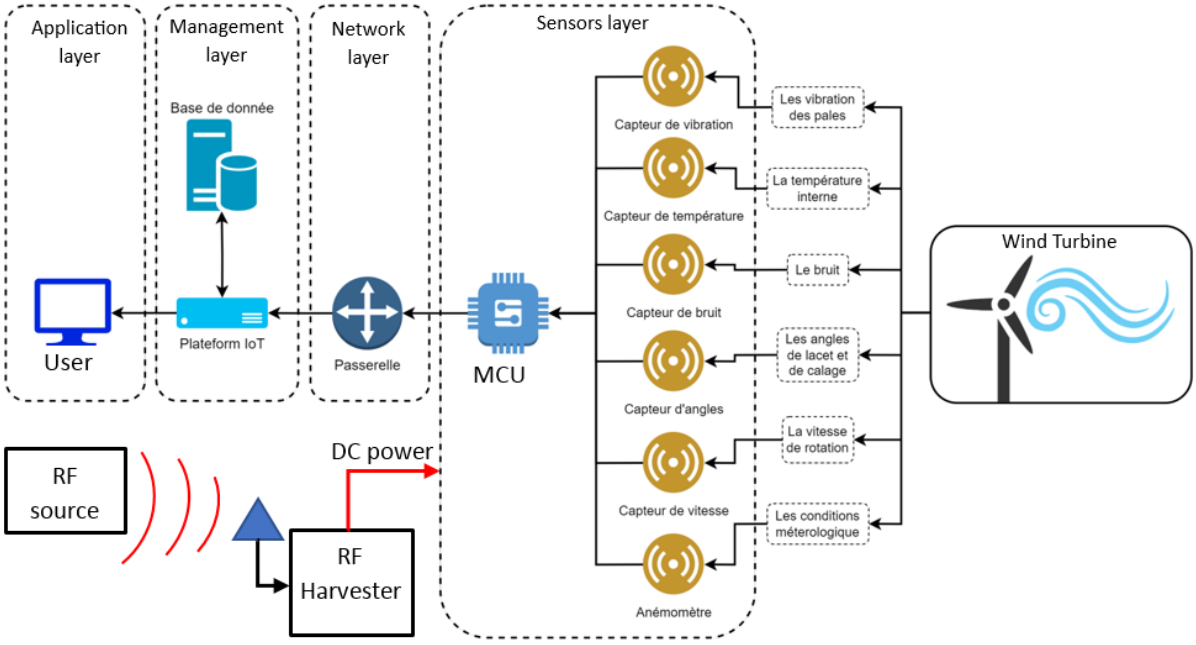

Fig. 1. The architecture of the realized monitoring system.

PEM fuel cell model parameters extraction based on Differential evolution optimization.

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Abstract

Accurate modelling of fuel cells (FC) is essential to better control their operation. In this paper proposed ad Differential evolution (DE) optimization algorithm taking into account the measurement uncertainty to estimate the parameters of the proton exchange membrane fuel cell (PEMFC) for their electrical equations based on current-voltage characteristics (I-V). To evaluate the performance of the proposed algorithm, three commercial PEMFCs with their experimental data (I-V) are considered such as 250 W, moduler SR-12 .The cases of the models with seven parameters unknown and the learning technique have been treated. The performance analysis of the proposed method is carried out by applying the two sum squared errors (SSEbetween the estimated and experimental data, the proposed approach is affirmed by its great superiority compared to the other methods recently published in Literature.

keywords : Fuel cell, Differential evolution, Parameter estimation, and Metaheuristics algorithms

Graphical Abstract

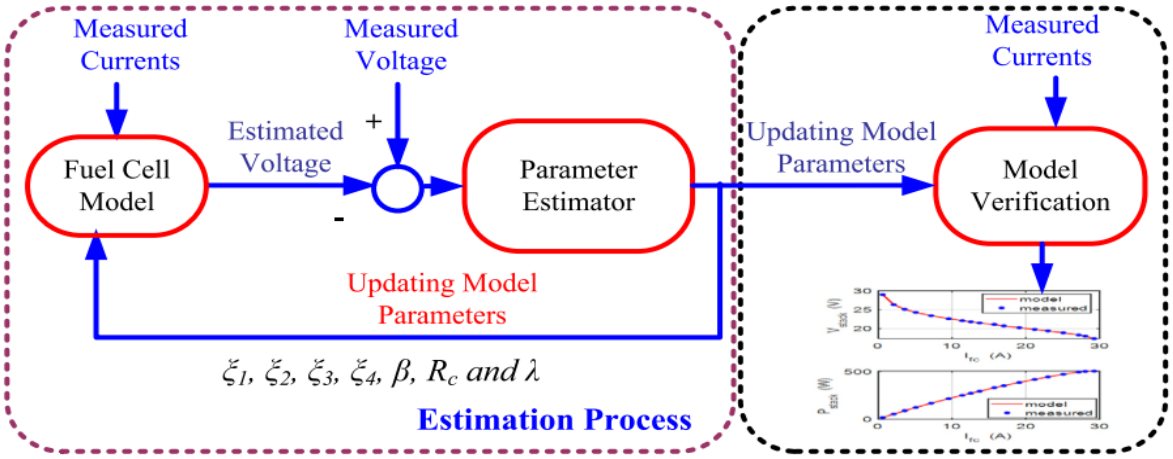

Fig.1. Representation of global parameter estimation

Performance Evaluation of a Stand-Alone Photovoltaic System for Rural Residential Applications in Ghardaia, Algeria

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Résumé

This paper presents a comprehensive design for a stand-alone photovoltaic (PV) system intended for rural residential applications in the region of Ghardaia. The location details and meteorological data pertaining to the proposed site are collected, along with the energy demand consumption. The proposed stand-alone PV system comprises photovoltaic panels, batteries, an inverter, and a charge controller. The process of constructing the stand-alone PV system involves designing, selecting, and evaluating the ratings of the PV system components. This process is influenced by factors such as load requirements, location coordinates, and solar irradiation levels. The sizing and design of the stand-alone PV system is performed based on calculations of the watt-hour demand. Additionally, a performance analysis of the proposed stand-alone PV system is conducted using the PVSyst simulation software. The simulation results encompass the total energy generated by the PV array, unused energy, energy supplied to the load, PV conversion efficiency, system losses, performance ratio, and other relevant parameters. This paper will be beneficial in sizing and designing stand-alone PV systems for other locations by following the procedure adopted herein.

Mot clé: Rural electrification, Stand-alone, PVSyst software, performance analysis, system losses.

Résumé graphique

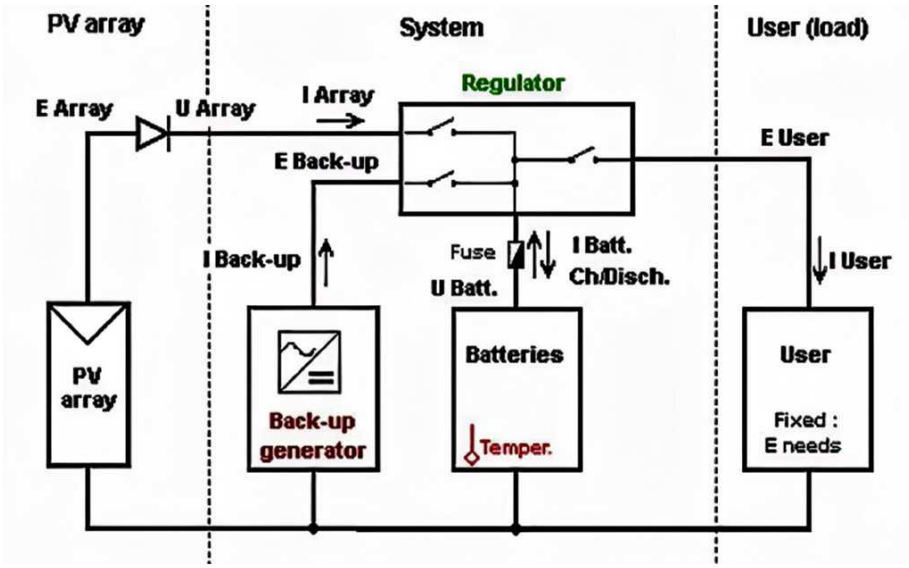

Fig.1. Block diagram of the autonomous PV system

Parameter optimization of building brick integration phase change material based on the energy consumption characteristics under hot climate.

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Abstract

One of the largest consumers of energy is the building sector, where nearly 30% of total energy is consumed by space cooling. The foundation for achieving zero-energy buildings is the utilization of renewable energy sources and energy conservation within the building envelope to enhance thermal comfort and reduce energy consumption. For this propos this paper presents a numerical study on the heat transfer characteristics of a porous brick filled with phase change materials (PCMs) in typical days of July 2021 in Bechar city (Algeria). Within the thermal model presented in this study, the PCM is filled into the square cavities of the bricks. The 2D numerical simulation was conducted utilizing Ansys Fluent software, employing finite volume analysis and the enthalpy porosity-based approach. The effectiveness of the integration of PCM in the building bricks has been evaluated by comparing two different cases - the normal bricks and bricks with PCM filled in the square cavities. Furthermore, the study was conducted with four different PCMs. The findings revealed that using PCM in building bricks stabilizes and reduces indoor temperature fluctuation. Using Capric acid as a PCM shows the lowest maximum temperature of 27.8°C with the peak indoor heat flux decreased by 34% and shifted by 2.5h.

Keywords: Solar energy storage; Energy consumption; Building brick; Phase Change Materials; Thermal comfort

Solar Air Heater with Corrugated Absorber Plate

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Abstract

A detailed numerical investigation of two-dimensional solar air heater (SAH) having corrugated absorber plate was performed in this study using CFD techniques. The main objective is the improvement of the heat transfer rate and the determination of the optimum corrugation characterization that provides high thermo-hydraulic performance for the adopted SAH. Mainly, the effect of the corrugated height ratio e/D and the corrugated pitch ratio P/e, for several values of Reynolds number are investigated. Results showed that the maximum value of Nusselt number is obtained for P/e = 7.14 and e/D = 0.166 with a heat gain of about 37.31 % compared to the smooth duct for Re = 18,000. The friction factor increases with decreasing P/e ratio and increasing e/D ratio. The highest value is obtained for P/e = 7.16 and e/D = 0.166. The optimum value of thermos-hydraulic performance parameter (THPP) could be obtained for P/e = 16.66 and e/D = 0.0656.

Keywords: Solar air heater, Corrugated plate, Heat transfer, Thermo-Hydraulic Performance

Étude numérique de l'effet de la forme des têtes des tubes caloporteurs dans le réservoir de stockage thermique d'un chauffe-eau solaire.

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Résumé

Ce travail vise à simuler la génération de chaleur des tubes caloporteurs du système de stockage thermique, qui est considéré comme le principal dispositif constituant les systèmes de chauffage solaire de l'eau. Pour ce faire, une étude numérique bidimensionnelle du régime d'échange de chaleur par convection naturelle a été menée.

Les têtes des tubes caloporteurs sont situées sur la paroi inférieure du réservoir de stockage thermique où une température isotherme ou un flux de chaleur sont appliqués. En outre, des études paramétriques concernant la géométrie des têtes des tubes caloporteurs ont été réalisées. Trois cas ont été étudiés : configurations circulaire, rectangulaire et triangulaire.

Les contours de température et l'évolution de la température moyenne à l'intérieur du réservoir de stockage thermique ont été présentés pour différentes configurations. Les résultats ont montré que la configuration circulaire des têtes des tubes caloporteurs est la plus efficace puisqu'elle permet un écoulement uniforme des fluides. Cela réduit les zones de stagnation et favorise une répartition homogène de la chaleur. Les écoulements turbulents générés par la forme circulaire contribuent également à un meilleur mélange des fluides. L'eau chauffée atteint une température de 72 °C. En revanche, la configuration triangulaire parvient à chauffer l'eau à 69 °C, tandis que la configuration rectangulaire atteint une température de 67 °C.

L'étude actuelle vise également à déterminer la position optimale pour l'entrée d'eau froide et la sortie d'eau chaude. En réalité, l'objectif est de chauffer l'eau à l'intérieur du réservoir de

stockage et de déterminer la configuration optimale qui offre le rendement le plus élevé. La comparaison des différentes géométries des têtes des tubes caloporteurs et l'évaluation de l'emplacement optimal de l'entrée/sortie d'eau, ont indiquées que le cas circulaire, avec l'entrée d'eau en bas et la sortie en haut, est la configuration la plus optimale par rapport aux autres cas testés.

Mot clé : Collecteur solaire, réservoir de stockage, CFD, échange thermique.

Résumé graphique

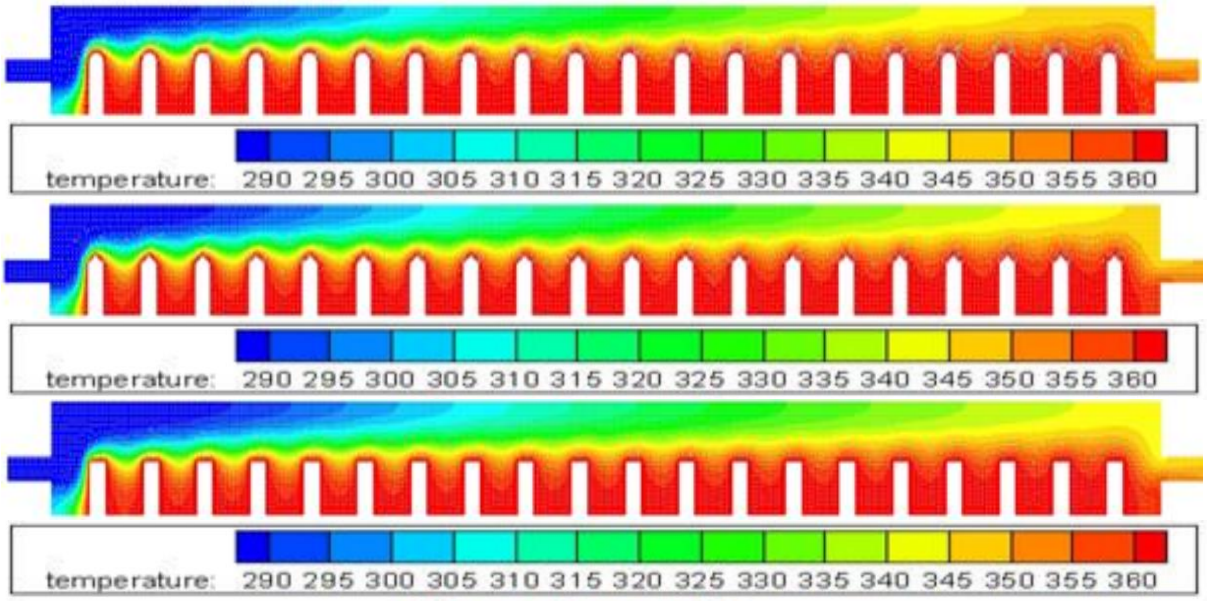

Fig.1. Contours de température dans le réservoir de stockage thermique pour les trois configurations : circulaire, triangulaire et rectangulaire.

Simulation of a multilayer SPR detector for biogas detection based on the FEM

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Résumé

Recently, the application of surface plasma resonance (SPR) has become one of the most pioneering technologies in the field of optical sensors, and it has received very wide attention in many fields, in addition to being exploited in multiple applications, the most important of which is biogas detection. In this study, a simulation of the structure response of multilayer surface plasmon resonance (SPR) is presented. In this work, we focused on the problem of angular interrogation in addition to its response in the visual range and in TM mode , In this study, we also relied on the COMSOL Multiphysics software and the FEM (finite element method) Because it is one of the most important methods used to model the optical response in nanostructures. In our work, a surface plasmon resonance (SPR) sensor was proposed as a method for biogas detection with a heterogeneous metal nanolayer with a refractive index n2 and a dielectric layer with a refractive index n1and a refractive index n3 for the biogas detection area as shown in Figure 1. From the results obtained, it was found that the effect of surface plasmon resonance (SPR) is present in all reflection curves. We also notice that there is a change in the resonance angle from 49.5 [deg] to 51.76 [deg], which corresponds to the change in the refractive index of the biogas detection region from 1.33 to 1.36, in addition to an increase in The minimum reflectance (Rmin) ranges from 0.219 to 0.2430, It was also shown that the device The proposed sensor has good linearity and high sensitivity equal to S=72.66 [deg/RIU]. All of these results indicate that this proposed sensor works well with metal nanostructures and with high sensitivity, and therefore it is considered a good option for exploitation in biogas detection.

Mot clé : Surface plasmon resonance, biogas, COMSOL Multiphysics, FEM

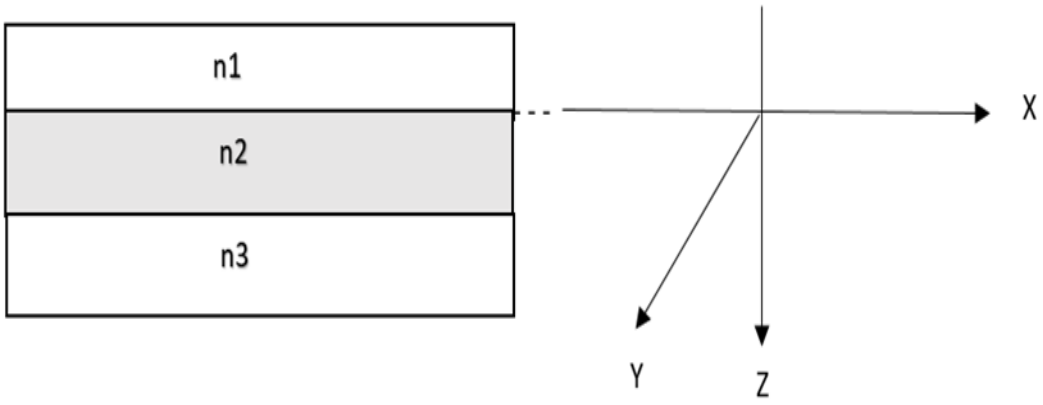

Fig.1. Proposed SPR structure

Effet du Taux d'Étirement et de la Dilution par CO_2 sur la Flamme de Diffusion Laminaire à Contre-Courant du Mélange Biogaz-Syngaz.

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Résumé

Les enjeux environnementaux liés à l'utilisation des combustibles fossiles rendent cruciale l'amélioration des systèmes de combustion pour minimiser leurs émissions nocives. Dans cette perspective, notre étude explore une stratégie intégrant l'usage de biocarburants et leur dilution. Nous analysons l'impact sur l'efficacité de la combustion, des types le volume du diluant (de 0 % à 40 %) et le côté de son injection , les pertes par rayonnement, ainsi que la vitesse d'injection. L'oxydant consiste en de l'air ($0.21O_2 + 0.79N_2$), tandis que le combustible est un mélange équimolaire de biogaz et de syngaz (($0.25CH_4 + 0.25CO_2$) + ($0.25H_2 + 0.25CO$)). Nous utilisons une configuration de flamme à jets opposés sous une pression atmosphérique constante, avec la cinétique chimique décrite par le mécanisme Gri-Mech 3.0. Nos résultats s'alignent bien avec les données existantes dans la littérature. L'introduction de CO_2 s'avère efficace pour abaisser les températures maximales et réduire les émissions de NOx, de CO, de C_2H_2, ainsi que d'autres particules de suie, indépendamment du côté d'ajout. En outre, les températures maximales et

les limites d'extinction (c'est-à-dire la stabilité de la flamme) obtenues par la dilution côté carburant surpassent celles réalisées par la dilution côté oxydant. Cependant, ce dernier reste préférable dans les contextes où une grande vitesse d'injection n'est pas nécessaire. La découverte majeure de cette étude est que l'influence de la dilution, notamment le site et la concentration du diluant, prédomine sur celle de la vitesse de déformation pour réduire la température maximale de la flamme, mettant en exergue l'importance critique des paramètres de dilution dans les démarches visant à réduire les émissions.

Mot clé : Mélange Biogaz-Syngaz, Flamme de diffusion, taux d'étirement, dilution par CO_2, température maximale de la flamme.

Résumé graphique

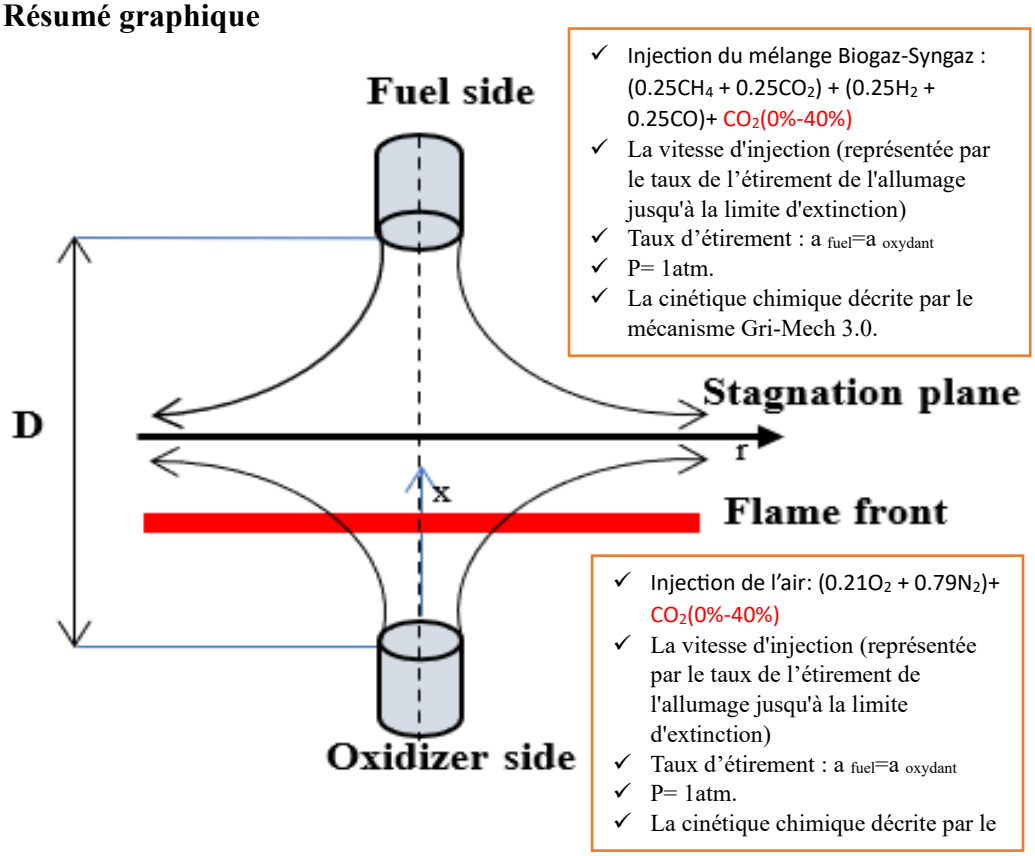

Fig.1. Configuration de la flamme de diffusion à contre-courant du mélange Biogaz-Syngaz/Air dilué par CO_2.

Etude Numérique d'un Capteur Solaire Hybride PVT Situé à Batna

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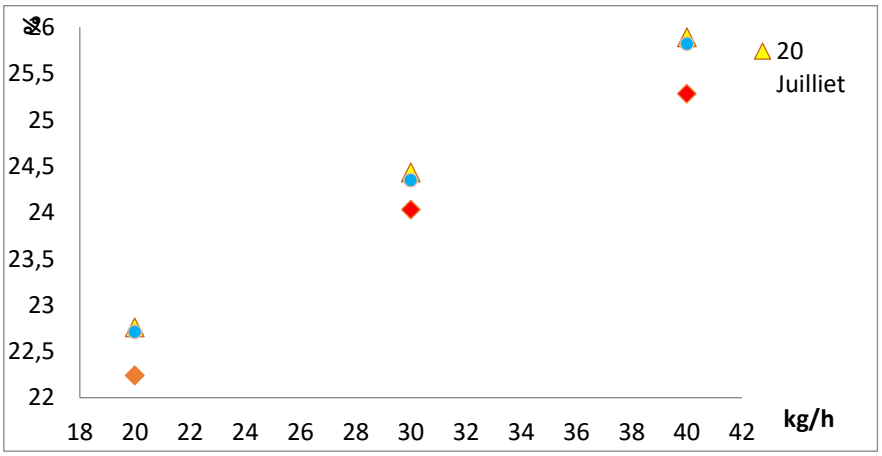
Résumé

Le dimensionnement des capteurs solaires thermiques doit être ajusté correctement en fonction des besoins spécifiques de chauffage. Un dimensionnement excessif peut augmenter les coûts de fabrication et d'installation et entraîner une diminution des performances thermiques. Tandis qu'un dimensionnement insuffisant peut entraîner une diminution de l'efficacité. Une étude numérique d'un capteur solaire à eau a été réalisée sous les conditions climatiques de Batna. Afin de trouver de bonnes performances, nous avons mené notre étude pour différent nombre de tubes. Les performances de ce type de capteur dépendent aussi de plusieurs autres facteurs, tels que le débit du fluide, les propriétés thermiques des matériaux du capteur solaire étudié, et les conditions environnementales. Les simulations de l'étude ont été effectuées à l'aide du logiciel Ansys Fluent en utilisant pour trois jours typiques: un en été, un au printemps, et un en automne. Les résultats montrent que le nombre de tubes n'a pas d'effet sur la température de l'eau à la sortie, alors que le débit de l'eau a un effet significatif.

Mots clés

Cellule photovoltaïque, énergie solaire, système thermique photovoltaïque hybride, CFD.

Courbe



Evolution de L'efficacité thermique en fonction du débit.

Numerical evaluation of propane/syngas flame CO/CO2 emissions in preheated air combustion and oxygen-enhanced combustion

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Abstract

Climate change and energy crises are among the world's biggest problems today. One of their leading causes is the use of fossil fuels and their carbon emissions. Several alternative fuels and combustion technologies have been developed to address these issues. In this light, we investigated the carbon emissions of propane/syngas mixture diffusion flame in oxygen-enriched combustion where the oxygen mole fraction was varied from 0.21 to 0.3 and preheated-air combustion where the oxidizer injection temperature was varied from 300 K to 500 K was conducted. The fuel injection temperature was kept constant and equal to 300 K, and the injection velocities of the fuel and the oxidizer were equal and varied from ignition to extinction in terms of strain rate. Finally, the pressure is constant and equal to 1 atm. The Chemkin code fed with the kinetic model USC Mech ver 2.0 was adopted in this study. It is found that increasing syngas mole fraction in the fuel mixture enhances flame temperature, extends the flammability limits, and reduces CO/CO2 emission. Moreover, it was noted that under the oxygen-enhanced combustion condition, the flame temperature is significantly enhanced, and the CO/CO2 emission increases Furthermore, it was remarked that under the preheated-air combustion condition, the flame temperature experiences a considerable increase; consequently, the CO emission increases due to CO2 disposition thus, its reduction.

Keywords: Syngas, Oxygen-enhanced combustion, Preheated air combustion, carbon emissions.

Béton ordinaire à performances mécaniques et thermiques améliorées

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Résumé

Cet article présente une étude de caractérisation mécanique et thermique du béton sous différentes conditions de cure. L'étude consiste en la préparation de plusieurs éprouvettes en béton ordinaire avec un sable reconstitué avec un ajout de 18% de fillers calcaires 0/80 µm. Son but est de valoriser des sables contenant un taux élevé de fillers disponibles en grande quantité en Algérie. Les éprouvettes sont placées dans un environnement totalement humide et ensuite retirées à des différents jours d'intervalles pour estimer à 28 jours la conductivité thermique, la vitesse de propagation des ultrasons ainsi que la résistance à la compression. Les résultats montrent que les fillers calcaires peuvent d'une part modifier le processus d'hydratation du ciment ainsi que la structuration des produits hydratés et, d'autre part, de réagir en milieu cimentaire pour former de nouveaux produits hydratés. La variation de la résistance à la compression enregistrée peut atteindre 65.61% entre les deux expositions extrêmes. Cette dispersion des résistances à la compression est confirmée par l'évaluation non-destructive où la différence entre les vitesses des ondes ultrasonores avoisine les 20.28 %. Il a été aussi remarqué l'apparition d'une corrélation positive entre le temps d'immersion dans l'eau et la conductivité thermique. En effet, l'écart de conductivité thermique peut atteindre 34.59 % sur la globalité de l'intervalle du temps d'immersion appliqué.

Mot clé : fillers, béton ordinaire, résistance, conductivité thermique, valorisation, performances énergétiques.

Électrode au plomb dans un environnement fortement alcalin pour augmenter la tension de la batterie au plomb

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Résumé

Étant donné les bénéfices des batteries rechargeables aqueuses en matière de sécurité, de prix abordable et de durabilité, elles ne peuvent pas rivaliser avec les batteries lithium-ion à base organique en raison de la faible stabilité électrochimique de l'eau (1,23 V). On a introduit une configuration à double électrolyte pour les supercondensateurs à base d'eau afin d'accroître la capacité de fonctionnement des dispositifs de stockage d'énergie à base d'eau. Ces dispositifs ont été élaborés dans une cellule composée de deux compartiments, contenant une solution alcaline et acide. D'autres études ont employé une membrane échangeuse d'ions (IEM) afin de prévenir la diffusion croisée de H^+ et OH^-, ce qui a permis de supprimer la neutralisation acido-basique. Dans un environnement fortement alcalin, le plomb montre une réaction réversible à l'électrode négative, ce qui entraîne une tension de chute d'électrode de -0,95 V/Ag.AgCl. Lorsque cette électrode est liée à une électrode PbO_2 dissoute dans de l'acide sulfurique dans une cellule multi-électrolyte, une force électromotrice de 2,5 volts est produite. La tension aux bornes de la cellule augmente de 20 % par rapport à une cellule PbO_2/Pb classique. D'un autre côté, cette chimie de batterie permet d'augmenter la capacité théorique de la cellule de 18 %.

Mot clé : batteries rechargeables, double électrolyte, stockage d'énergie, membrane échangeuse d'ions, La tension, capacité théorique.

Résumé graphique

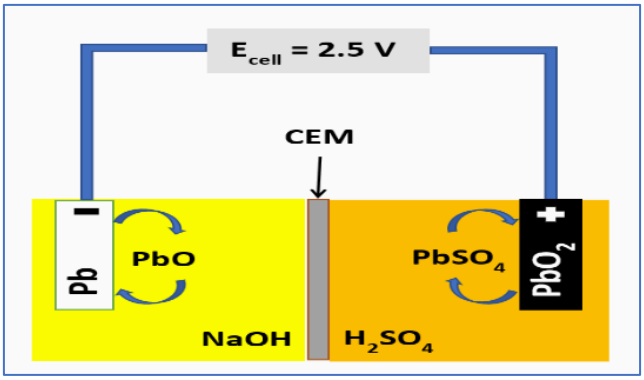

Fig.1. Configuration schématique d'une batterie PbO_2-Pb avec double électrolyte H_2SO_4-NaOH.

Amélioration du refroidissement d'un composant électronique par l'insertion des systèmes déprimogènes

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Abstract :

Avec le développement de l'électronique, les composants électroniques deviennent de plus en plus petits et libèrent de plus en plus de chaleur, cette chaleur doit être évacuée de manière efficace et rapide. Les performances des composants électroniques diminuent fortement avec l'augmentation de leur température. L'objectif sera donc de maintenir ou augmenter ces performances. Des simulations numériques sont faites pour traiter le transfert de chaleur d'un écoulement d'un fluide en régime laminaire traversant un tube soumis à une puissance dégagée d'un composant électronique. Pour la réalisation de ce travail nous utilisons des systèmes déprimogènes sous différentes formes insérés à l'intérieur du tube. Afin d'augmenter l'amélioration du refroidissement du composant électronique nous utilisons aussi du nano fluide (Cu-Eau) avec des fractions volumiques des nanoparticules de 0,02% ; 0,04%. Les résultats ont indiqué qu'une augmentation de la fraction volumique de nanoparticules solides conduit à l'amélioration du coefficient de transfert de chaleur par convection du fluide de refroidissement, tandis que l'augmentation du nombre de Nusselt entraîne une perte de coefficient de frottement et de pression. De plus, avec l'incrément de vitesse du fluide, il y aura une proportion optimale entre la chaleur et le comportement de transfert hydrodynamique qui optimise l'évaluation des critères d'évaluation de performances (PEC).

Mots clés : Systèmes déprimogènes, nano fluide, refroidissement, électronique, convection, CFD, fraction volumique

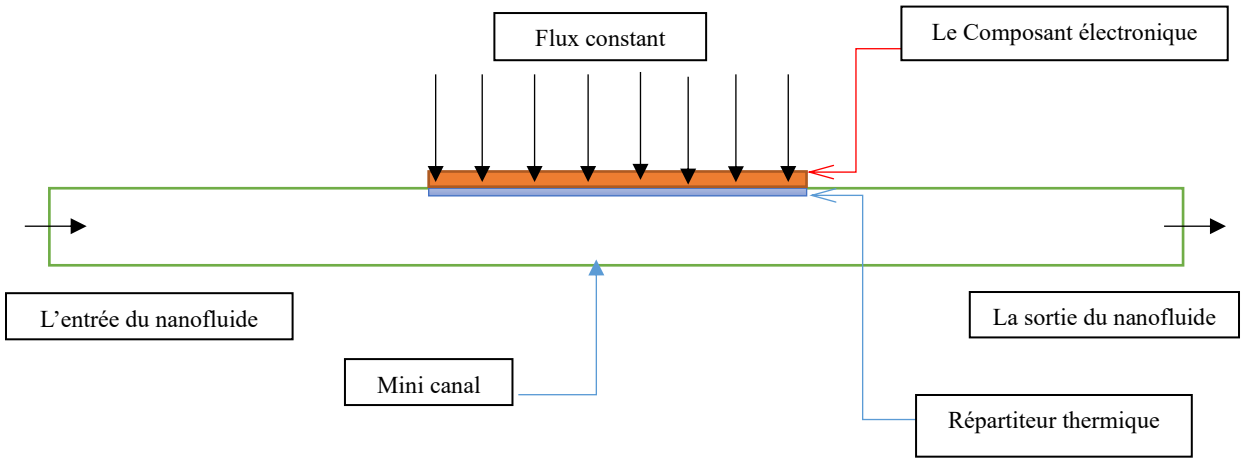

Fig.1 : Présentation de la géométrie du micro canal et le composant électronique à refroidir.

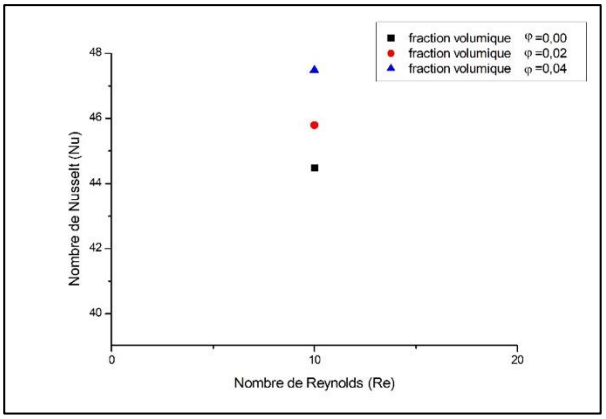

Fig.2 : Comparaisons du nombre de Nusselt en fonction de la concentration des nanoparticules pour Re=10

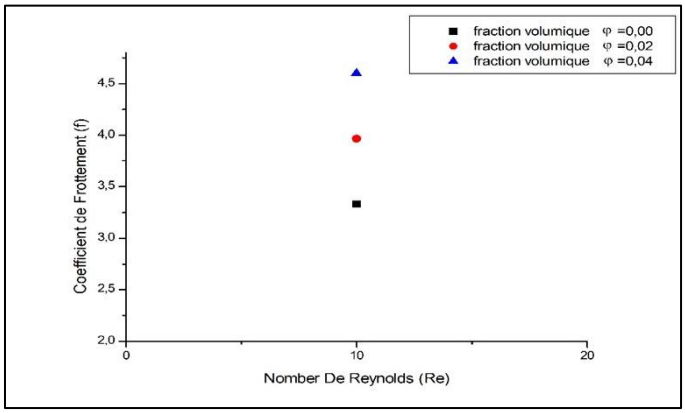

Fig.3 : Comparaisons du coefficient de frottement en fonction de la concentration des nanoparticules pour Re=10

Etude numérique de la convection naturelle dans un canal horizontal comportant un nombre infini de blocs

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Résumé

Le transfert de chaleur est fréquemment rencontré dans la nature et dans différents systèmes industriels. Il résulte d'une interaction complexe au sein d'un milieu ou entre milieux dès qu'il y a un gradient de température. L'une des formes de transfert de chaleur est la convection naturelle qui fait l'objet de nombreux travaux de recherche. Le canal contenant des blocs compte parmi les configurations qui ont suscité l'intérêt des chercheurs de l'ingénierie en raison de son implication dans divers domaines tels que le stockage de l'énergie et le refroidissement des composants électroniques et des systèmes de production de l'énergie nucléaire et chimique. L'étude vise à réaliser une simulation numérique de la convection naturelle bidimensionnelle dans un canal horizontal contenant des blocs chauffant repartis périodiquement sur sa paroi adiabatique inferieure afin d'examiner la validité du modèle à blocs isothermes pour un système physique en fonction des paramètres de contrôle.

Cette étude numérique a mis en évidence l'influence significative du nombre de Rayleigh et de forme géométrique des blocs solides (cubique et hémicylindrique) sur le champ dynamique et thermique et permet de choisir la forme de la surface pour favoriser un bon échange thermique. La simulation réalisée à l'aide du logiciel Fluent 17.2 basé sur la méthode des volumes finis ; a permis de présenter et de discuter les résultats pour des nombres de Rayleigh allant de 7.10^4 à 10^8. Ils montrent que l'écoulement et le transfert de chaleur sont fortement influencés par les paramètres de contrôles.

Ces résultats démontrent une forte influence des paramètres de contrôle sur l'écoulement et le transfert de chaleur. Notamment, l'échange thermique s'avère plus efficace avec les blocs hémicylindriques par rapport aux blocs cubiques. Ainsi, dans la conception des échangeurs de chaleur, il est recommandé de privilégier l'utilisation de blocs hémicylindriques où circule le fluide caloporteur.

Mot clé : : Convection naturelle, Canal horizontal, Blocs chauffants, Simulation numérique.

Résumé graphique

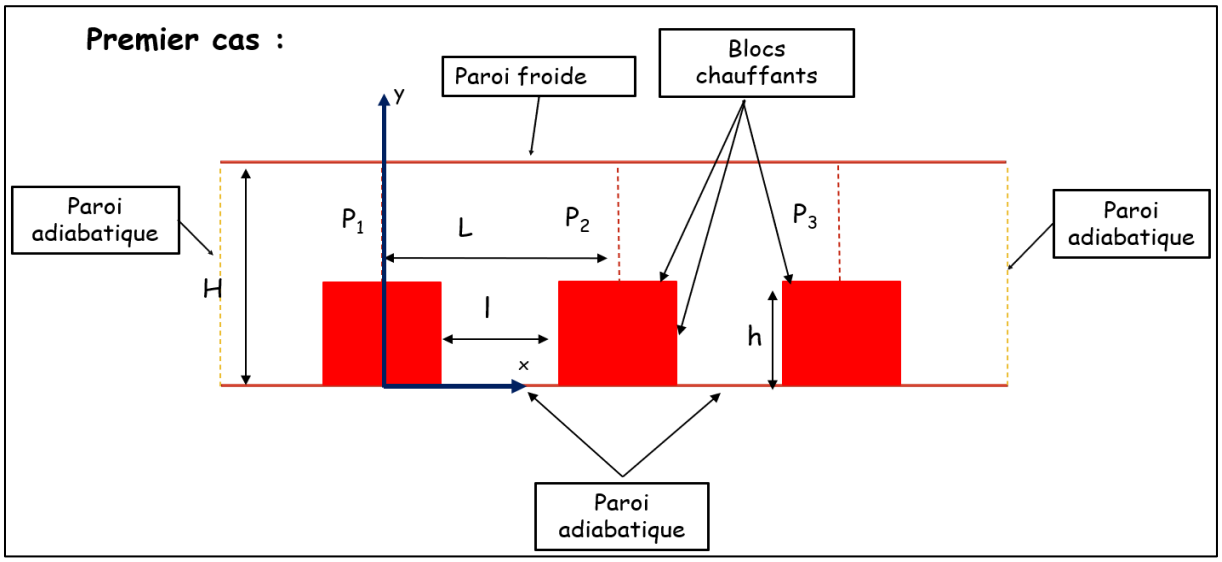

Fig.1. Canal comportant un nombre infini de blocs cubiques.

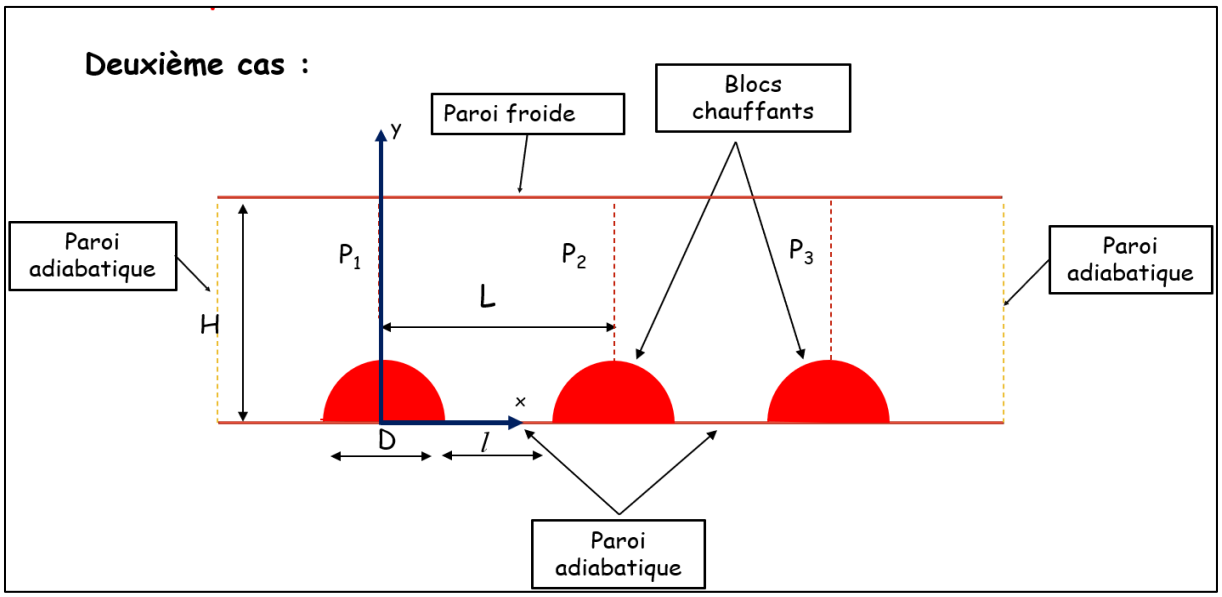

Fig.2. Canal comportant un nombre infini de blocs hémicylindriques.

Experimental study of performance and thermal dissipation for straight tubes

Cheriet K [a], Demagh Y [b], Serir L [a,b],

Abstract

An experimental study was conducted on a straight heat exchanger and its thermal performance. A three-dimensional model of the experimental setup was designed using software. This study focused on the analysis of a circular stainless steel tube of type 316L, with a smooth and straight-wall configuration having a length of 4.49m, an outer diameter of 14mm, and a thickness of 1mm. The results obtained show a very close resemblance between the empirical formula of the friction coefficient by Churchill and the experimental data, with a relative error of 5.7% in the turbulent region. Furthermore, the experimental results regarding the heat transfer coefficient closely match the values calculated using the empirical formula by Theodore L. Bergman, with a maximum relative error not exceeding 3.7% in the turbulent region

Keywords:

stainless-steel heat exchangers turbulent region friction factor

Enhancing the efficiency of flat plat solar thermal collectors through computational simulations

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(2) University of Blida 1, institute of aeronautics and space studies, Blida, Algeria

Abstract

Flat plate solar thermal collectors are integral to harnessing solar energy for heating applications, providing a sustainable alternative to traditional energy sources. Despite their importance, they face persistent challenges, notably low energy conversion rates.

In response to these challenges, this study is dedicated to optimizing the performance of flat plate solar thermal collectors. This optimization is achieved through structural modifications aimed at enhancing efficiency. Specifically, we propose implementing numerical simulations to assess the impact of design parameters, such as the air gap thickness, on the collector's performance.

By conducting these simulations on a novel solar collector design, we aim to gain insights into how various structural adjustments can improve energy conversion efficiency. This research will contribute to advancing the effectiveness and viability of flat plate solar thermal collectors in the renewable energy domain.

Intégration de l'énergie solaire dans les milieux urbains: Revue des avancées en planification urbaine durable et des innovations en conception énergétique

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Résumé

La structure spatiale des villes a une influence directe sur la consommation énergétique. Avec l'urgence croissante d'alternatives énergétiques durables, l'intégration des systèmes d'énergie solaire dans les paysages urbains a pris de l'importance. Cependant, les stratégies pour cette intégration demeurent un défi majeur pour les urbanistes et les administrateurs municipaux. Les milieux urbains présentent des défis spécifiques pour la mise en place de l'énergie solaire, comme la limitation de l'espace, l'ombrage et les aspects esthétiques. En utilisant une approche scientométrique et systématique de revue de la littérature, nous examinons en profondeur l'état actuel de l'intégration de l'énergie solaire dans les zones urbaines, mettant l'accent sur les innovations en matière de conception et d'efficacité. L'objectif de cette revue est d'analyser différentes approches de conception pour relever ces défis, telles que l'incorporation de panneaux solaires dans les façades des bâtiments, les fenêtres et les infrastructures urbaines. L'étude de ces progrès permet d'avoir une vision de la façon de maximiser la collecte d'énergie, tout en intégrant de manière harmonieuse les technologies solaires dans les zones urbaines. De plus, l'article analyse des méthodologies émergentes qui améliorent l'efficacité des systèmes d'énergie solaire dans ces contextes, notamment les avancées dans les cellules photovoltaïques et les solutions de stockage d'énergie. En conclusion, cette revue propose un examen nuancé

du paysage évolutif de l'intégration de l'énergie solaire dans les zones urbaines. En explorant les innovations en matière de conception et les améliorations de l'efficacité, le document apporte des informations précieuses aux chercheurs, aux décideurs politiques et aux praticiens cherchant à promouvoir des solutions énergétiques durables dans l'environnement urbain.

Les mots-clés: Énergie renouvelable; Énergie solaire; Urbain; Innovation de conception ; une revue systématique

The continuous random walk model for the diffusion of solid transport of turbulent flows in the rough sewer pipe

Le modèle de marche aléatoire continue pour la diffusion du transport solide des écoulements turbulents dans un canal rugueux à surface libre

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[2] Hydraulic department, Batna2, Algeria

Abstract

At some locations along the length of open sewers and drains, sediment particles get deposited on the bottom bed, reducing hydraulic efficiency. Several investigators have conducted experimental and computational studies to understand the particle trapping behavior of invert traps of various shapes and depths under varying sediment and flow parameters. The current study investigated the particle trapping behavior in a sewer pipe.

an improved numerical method is proposed to describe particle scattering in turbulent flows, in which the turbulent motion of the liquid phase is solved by the Reynolds Averaged Navier–Stokes (RANS) equations while the solid particles are tracked by the Lagrangian approach. Interactions between fluid turbulence and solids are considered using the continuous random walk (CRW) model, in which the effect of particle inertia has been considered.

The flow structure, , velocity distribution, and particle deposition distribution in the in rough pipe were analyzed after a study of the grid independence and a numerical validation. The results showed that these mechanisms affected the flow structure in the flow field

The computational results are demonstrated to be in good agreement with the experimental data.

Keywords: Model (DPM), multiphase flow, turbulence, random walk model, simulation'

Experimental Investigation Of Solar Drying By Natural Convection Of Apple Slices

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Abstract

This experimental study investigates the behavior of food product drying using a solar cabinet dryer, apple slices were dried in thin layers, and three different drying air velocities were evaluated to determine their effect on drying time. This study examines the drying of apple slices in thin layers, which are sliced with a radius of 32 mm and thicknesses of 1, 2, and 3 mm. Several variables influence drying speed, including the product's arrangement, temperature, and draining airflow; the apple thin pieces serve as an experimental way to determine moisture content curves. The results showed that the drying kinetics were impacted by the previously described parameters, and airflow had a part in accelerating the drying process. The decreased moisture ratio (MR) curves determined by a variety of models (Newton, Logarithmic, Henderson, and Pabis) were compared to the extracted model with the experimental results as a function of time. The logarithmic model was found to be in excellent agreement with the experimental results and outperformed all other models in all curves, although the extracted model was in most cases in agreement with the Henderson, Pabis, and Newton models. This led to the conclusion that the logarithmic model was an appropriate model for explaining the drying behavior of apple slices.

Keywords: Drying process, apple, thin layer drying model, solar drying,

Résumé graphique

Wet and dried slices of apple with 1mm of thickness and 32mm of radius

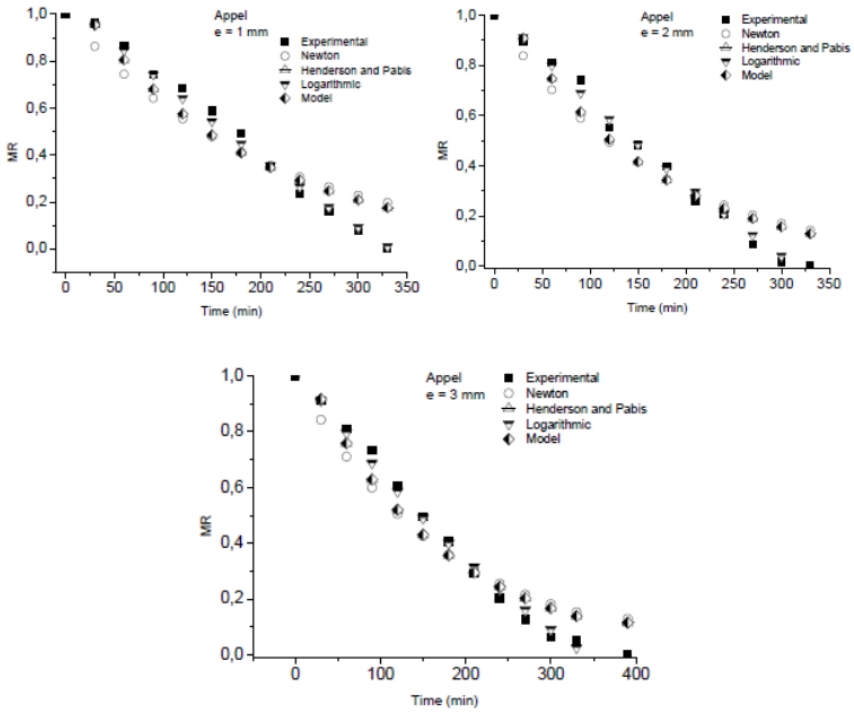

Fig.1. The moisture ratio versus drying time for different models of apple slices with 1, 2, and

Simulating Horizontal Geothermal Heat Exchangers for Irrigation Water Cooling in Biskra Using CFD

Chaima Toumi[1*], Mohamed Aymen Kethiri[2,3], Yousra Boutera[1*], Charafeddine Beldjani[2], Kamel Aoues[2]

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[2]*Laboratoire de Génie Energétique et Matériaux, LGEM, University Mohamed Khider of Biskra, B.P. 145, RP 07000, Biskra, Algeria.*

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Abstract

This study is a numerical analysis aimed at identifying the factors that significantly impact the performance of geothermal exchangers. It primarily explores the application of geothermal energy for cooling irrigation water. Specifically, the research investigates horizontal coil heat exchangers across various flow rates, materials, and operational durations to evaluate their efficiency in different installation scenarios and working conditions. The analysis utilized the Computational Fluid Dynamics (CFD) Fluent software, focusing on the climatic conditions during the summer season in southern Algeria, particularly in Biskra. The findings reveal that the most crucial parameter for this system's heat transfer efficiency is its availability; the optimal duration of operation was determined to be 6 hours in the scenarios examined in this study. Additionally, the selection of fluid velocity within the tubes emerged as another vital factor. According to the literature, the recommended installation depth for horizontal ground heat exchangers is 3 meters.

Keywords : Geothermal Energy, Heat Exchanger, Irrigation Water, Cooling, CFD Simulation.

Résumé graphique

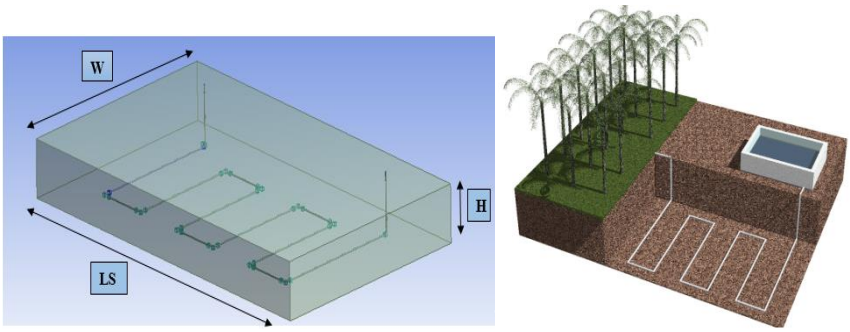

Fig. 1. Description of the proposed configuration.

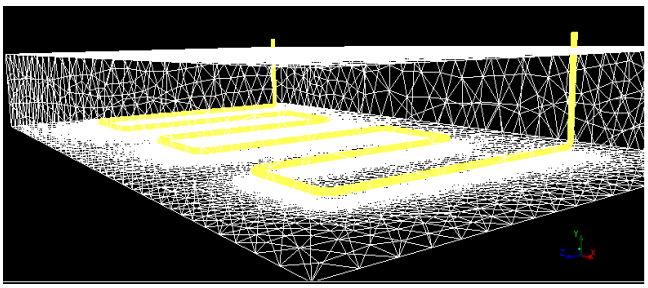

Fig.2. Mesh.

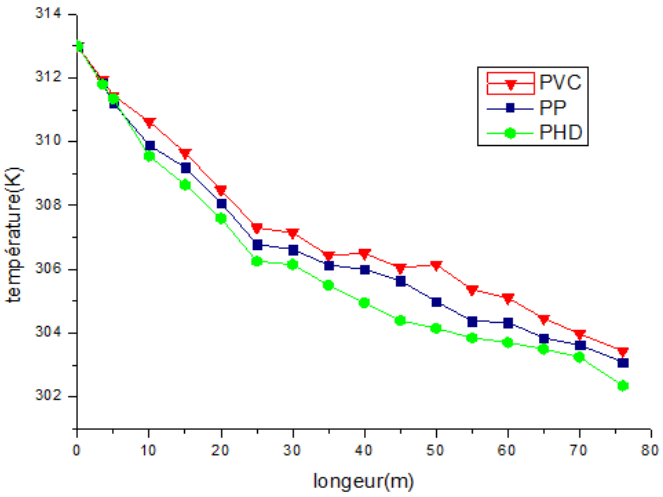

Fig. 3. Variation of the outlet temperature as a function of the length of the tube for different thermal conductivities of the tube (0.1kg / s).

Gestion des déchets et évaluation des émissions de biogaz dans le CET de Batna : Analyse et perspectives

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Résumé

Les centres d'enfouissement technique (CET) constituent une part essentielle de la gestion des déchets, avec un potentiel significatif de production de biogaz. Cette étude se concentre sur l'évaluation des émissions de biogaz dans les CET de Batna, en examinant les méthodes de mesure, les facteurs de production de biogaz et leurs implications pour l'environnement et la santé humaine. À travers une analyse exhaustive de la littérature, nous explorons les différents paramètres influençant la quantification des émissions de biogaz, notamment les conditions environnementales, les pratiques de gestion des déchets et les technologies de capture. Nous soulignons également l'importance de comprendre les mécanismes de formation du biogaz pour une évaluation précise des émissions. En outre, nous discutons des conséquences environnementales de ces émissions, telles que l'effet de serre et la pollution atmosphérique. En conclusion, nous mettons en avant la nécessité d'une approche intégrée pour gérer efficacement les émissions de biogaz dans les CET, en intégrant l'incinération des déchets spéciaux et en utilisant le biogaz comme carburant. Cette approche pourrait contribuer à atténuer les impacts environnementaux tout en offrant des opportunités de valorisation énergétique et économique. Enfin, nous identifions des pistes de recherche futures pour améliorer la compréhension et la gestion des émissions de biogaz dans les CET, afin de promouvoir une gestion des déchets plus durable et respectueuse de l'environnement

Mot clé : Centre d'enfouissement technique (CET) , Biogaz, Déchets, Prédiction, captage, puits

Résumé graphique

Fig.1. Déchets spéciaux .

Fig.2. La combustion de Biogaz

The effects of various parameters and shape of venturi of pulse jet cleaning on bag filter efficiency using CFD code and validated by experiment

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Abstract

The cement industry is responsible for the discharge of large quantum of pollutants into atmosphere affecting the ambient air quality, the volume of gas or air to be de-dusted varies between 6-15 m^3 per kilogram of cement product. To deal with this problem the bag filter which has been installed in cement industry has the characteristics of high efficiency and good economy and is widely used for dust treatment. Inlet gas containing dust passes through fabric filter bag, including dust particles to be caught by fibber structure of the filter bag, a dust cake, which is layer of aggregated dust particles is formed on the outer surface of the filter bag, as the dust cake grows, the pressure drop across the filter increases, resulting in a decrease in the filtration velocity and increase of the power consumption see figure 01. Pulse-jet cleaning process is a critical part of bag filter work flow, and has a significant impact on the operating stability of bag filter. Pulse-jet cleaning uses compressed air, which is injected into filter bag through the bag mouth, with an instant release mode. At the same time, the compressed air entrains a large amount of secondary air flow near the bag mount to enter the filter bag; the dust cake falls off from the surface under the combined action of primary compressed air and secondary air flow as shown in figure 02.

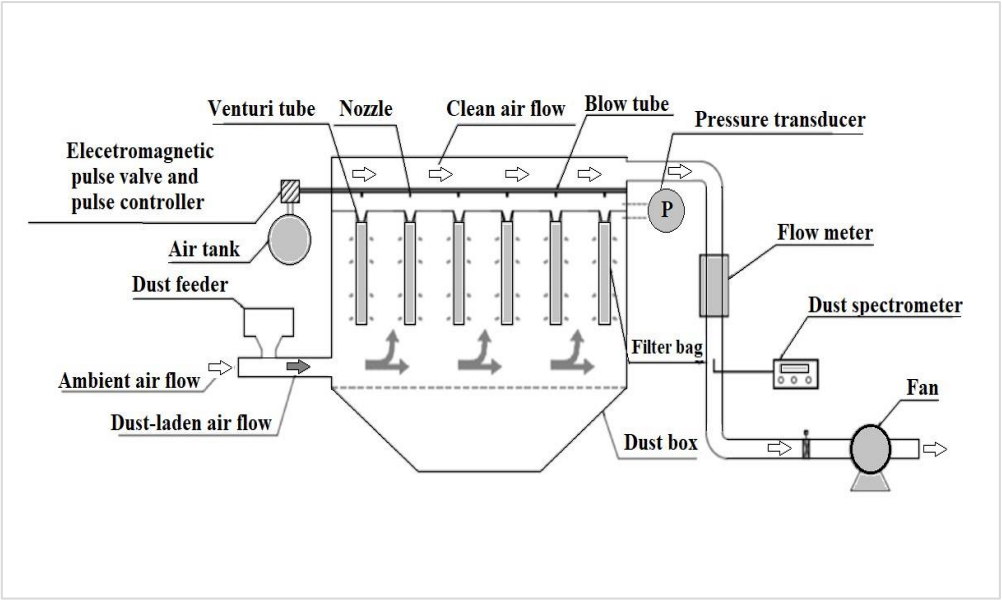

Figure 1. Semi industrial baghouse experimental device

A Comparative Study of Thermo hydraulic Behavior of Fe_3O_4-Ag and Fe_3O_4-Al_2O_3 Nanoparticles Suspended in Water/EG Mixture

Zeroual Hamza[1], Benkhedda Mohamed[1]

[1] Physics Departement, University of Boumerdes

Abstract:

The present study is a comparison of two hybrid nanofluids, represented by Fe_3O_4-Ag and Fe_3O_4-Al_2O_3, homogeneously dispersed in a mixture of water and ethylene glycol (50%-50%) flowing through a smooth horizontal heated tube. The partial differential equations (PDEs) in Cartesian coordinates are discretized using the finite volume method and the calculations were carried out using ANSYS FLUENT 23 software. The control parameters are the Reynolds number Re=500 and the volume fraction ranging from 2% to 6%. The results show that the Nusselt number and friction factor increases with increasing volume fraction. Moreover, entropy generation increased as the volume fraction of nanoparticles increased for both hybrid nanofluids.

Comparative Study between the Absorbed Energy Distribution Analysis of Nd:YAG and Ce:Nd:YAG Active Mediums in Solar-Pumped Lasers Using Off-Axis Parabolic Mirrors (OAPM)

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[b] LEVRES Laboratory, University of El Oued, 39000 El Oued, Algeria

*Corresponding author : kouicem96@gmail.com

Abstract

Sun-pumped lasers (SPLs) stand as a revolutionary technology in the field of solar energy sustainability, providing a novel approach in using the abundant energy of sunlight for a variety of applications and represent a very promising emerging technology that converts solar spectrum broadband into narrow-band radiation by utilizing natural sunlight to pump an active medium, . Nd:YAG and Ce:Nd:YAG are extensively utilized materials in solar laser applications, both relying on the $4_{F_{3/2}}$ ----> $4_{I_{11/2}}$ atomic transition. Numerous studies emphasize the significance of co-doped YAG crystals with Ce and Nd, enhancing overlap with the solar spectrum by providing additional energy level transitions.

This study investigates the efficacy of Ce:Nd:YAG co-doped crystals in enhancing the SPL performance compared to conventional Nd:YAG, using 12 mm diameter, and 48 mm length grooved Nd:YAG and Ce:Nd:YAG rods, side-pumped two off-axis parabolic mirrors (OAPM) within two V-shaped cavities, Zemax ray tracing software analysis and optimization asserts 264 w absorbed energy when utilizing Ce:Nd:YAG and 261.6 w when using Nd:YAG mediums, which lead directly to enhance the output power laser.

Key words: solar laser,Nd:YAG, CE :Nd:YAG,sun pumped laser.

Effect of heat transfer convective on the interface shape during the Czochralski growth of Ti:AL_2O_3 Material

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[(1)] *Centre de Recherche Scientifique et Technique en analyse physico-chimique CRAPC, Zone Industrielle lot n°30, Bou Ismail, Tipaza 42415, Algérie.*

[(2)] *LRPRIM Laboratory, Department of Physics, University of Batna1, 1 rue Chahid Boukhlouf Mohamed El-Hadi, 05000 Batna, Algeria.*

Abstract

In this work, we have established a three-dimensional numerical simulation to study the effect of crucible dimensions on melt convection and interface shape during Czochralski growth of ($Ti: Al_2O_3$) single crystal. The aim of this study is to optimize the growing conditions to pull high quality crystals for the laser application. We have been able to find the optimal conditions (the optimal rotation speed) keep the flow symmetric inside the crucible and leed to a flat liquid-solid interface. We found that the crucible dimensions have an effect on melt convection and interface shape during Czochralski growth.

Keywords: Crystal growth, Czochralski, Sapphire, Titanium, Free convection, Forced convection, Heat transfer, Numerical simulation.

The fabrication and utilization of distributed Bragg reflectors (DBRs) in solar cell application

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Abstract:

Solar cells rely on the photovoltaic effect. A photovoltaic cell's conversion efficiency depends on how well it absorbs a photon. Solar cells face a notable issue of incoming light loss, especially when the active layer is too thin. Optimizing conversion efficiency is a key goal of now research. Among existing solutions, distributed Bragg reflectors (DBRs) are used to create a structure that enhances light absorption in solar cells. DBRs are characterized by a stop band, also known as a band gap, which is a specific frequency range where light cannot pass through as the DBRs effectively reflect incoming light. By reflecting specific wavelengths of light into the solar cell, the absorption of photons is increased, and the efficiency of the solar cell is improved. In addition, DBRs also contributes to the stability and durability of solar cells by protecting the active layers from overexposure to certain wavelengths of light that can cause degradation, i.e., DBR helps extend the life of solar cells. The primary goal of this work is to fabricate DBRs with good reflective properties that can reflect as much sunlight as possible. To fabricate a DBRs, a dip-coating technique is used to apply SiO_2 and TiO_2 to glass substrates, resulting in the formation of a single bilayer. The procedure is repeated five times to obtain five bilayers. After precipitation of SiO_2/ TiO_2, the samples are subjected to heat treatment at 550 °C. The results obtained from UV–Vis spectrophotometer and Photoluminescence measurements show that the produced samples exhibit a flat central peak with a large level of reflectivity, up to 99.6%. Then, a gradual decrease in an oscillatory manner on both sides of the stop band. The current investigation provides an experimental demonstration that can serve as a viable approach to regulate the wavelength thereby optimising the yield of solar cells. The results of the research study provide new insights into the progress of high-efficiency solar cells and other emerging optoelectronic devices.

Key words: solar cells; distributed Bragg Reflector (DBR); sol-gel; SiO_2/ TiO_2; stop band.

Graphical abstract:

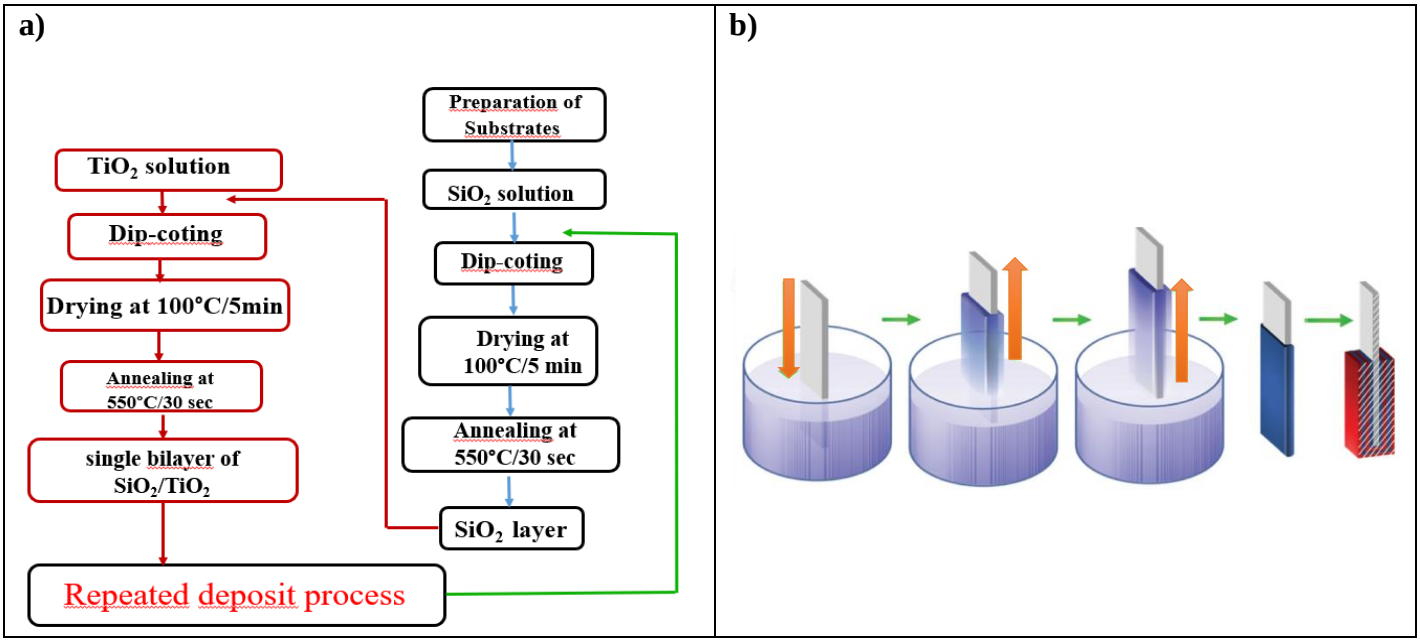

Fig.1. a) Process of fabrication of SiO_2/TiO_2; b) Schematic of the dip-coating technique.

THREE-DIMENSIONAL NUMERICAL STUDY OF SILICON (Si) CRYSTAL GROWTH FOR PHOTOVOLTAIC (PV) APPLICATIONS

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Abstract

In this work, we have established a three-dimensional numerical simulation to study the liquid-solid interface shape during Silicon Czochralski growth. The Czochralski (CZ) crystal growth method is the dominant technology for growing monocrystalline silicon used in the fabrication of high-efficiency solar cells in photovoltaic applications [1, 2]. The shape of liquid-solid interface is one of the most important factors in the solidification process, where the quality of the material drawn depends efficiently by this interface [3]. The goal of this research is to determine the optimal rotation speed giving a planar solid-liquid interface to pull high quality crystals for the photovoltaic applications, where we have studied the crystal rotation speed effect on the liquid-solid interface in the solidification of Silicon material. In order to grow a crystal with good optical and thermal quality in a short time, we have been able to determine the optimum rotation speed to minimize growth time; for which the symmetry of the flow in the Czochralski crucible is conserved.

Keywords: Solidification, Photovoltaic applications, Silicon, Crystal growth, Liquid-solid Interface, Czochralski.

Flow control around a straight Darrieus wind turbine using fixed and variable pitch approach

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Abstract

The straight Darrieus wind turbine is widely used in industrial and private sectors due to its independence of operation from wind direction, and its low cost in terms of design, installation and maintenance. However, its inability to self-start and the low wind energy extraction compared to the horizontal axis wind turbine are the main problems for its implementation. Currently, researchers are working for the active and\or passive control of the flow around the straight Darrieus wind turbines' blades in order to improve its self-starting and power curve. In this context, a comparative CFD analysis on a flow control using respectively a fixed and variable pitch mechanism on the blades' motion has been proposed on a three bladed Straight Darrieus wind turbine prototype. The blade model is designed with a NACA0015 profile about a 0.4m chord length and a spanwise of 3m. The turbine ratio is of 1.2. and its solidity of 0.48. The results show that the variable pitch improves the self-starting and reduces the dead zone of the wind turbine for the low amplitudes but the nominal power decreases. Over the studied range of variable pitch angle, the value of -3° has a significant improvement of the power curve. While the fixed pitch is reveled not favor for this model of wind turbine and the angle of 0° value remain the most optimal configuration.

Keywords: Straight Darrieus wind turbine, CFD, Fixed pitch, Variable pitch, Torque, Power coefficient

Investigation of Traps Density Effects on GaAs MESFET Characteristics Using Atlas Silvaco-TCAD Simulation

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Abstract:

The Schottky barrier field-effect transistor, MESFET, demonstrates significant importance due to its practical applications. Thus, this study focuses on investigating the influence of traps density on the characteristics of a GaAs MESFET. To achieve this, we developed a structure of a long-channel MESFET using Silvaco-Atlas, enabling a detailed examination of trap density's impact on output current (I_{DS}) concerning various parameters such as gate length, gate width, active region doping, channel thickness, and trap density, under different biasing conditions of V_{GS} and V_{DS}. The key findings can be summarized as follows: Certain results stand out, notably: (i) reducing the width of the space charge region leads to an increase in output current, (ii) decreasing gate length and surface trap density enhance the current, and (iii) increasing channel width, gate width, and doping elevate I_{DS}.

Keywords: MESFET, GaAs, ATLAS-SILVACO, Output current, traps density

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Numerical Investigation Of Nox Emissions In Syngas-Ammonia Diffusion Flames Under MILD Combustion Regime

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Résumé

The blending of ammonia with hydrocarbon fuels presents a promising avenue for curbing carbon emissions during combustion. In our investigation, we explore the effects of mixing ammonia with syngas, leveraging its hydrogen content to inhnaced flame stability. Employing the MILD combustion regime in order to mitigate NOx emissions significantly. Our results demonstrate notable improvements in combustion efficiency alongside a marked reduction in NOx emissions compared to conventional combustion regimes, underscoring the potential of this approach for sustainable energy utilization.

Mot clé : Ammonia. Syngas, MILD combustion, Non-premixed, biofules.

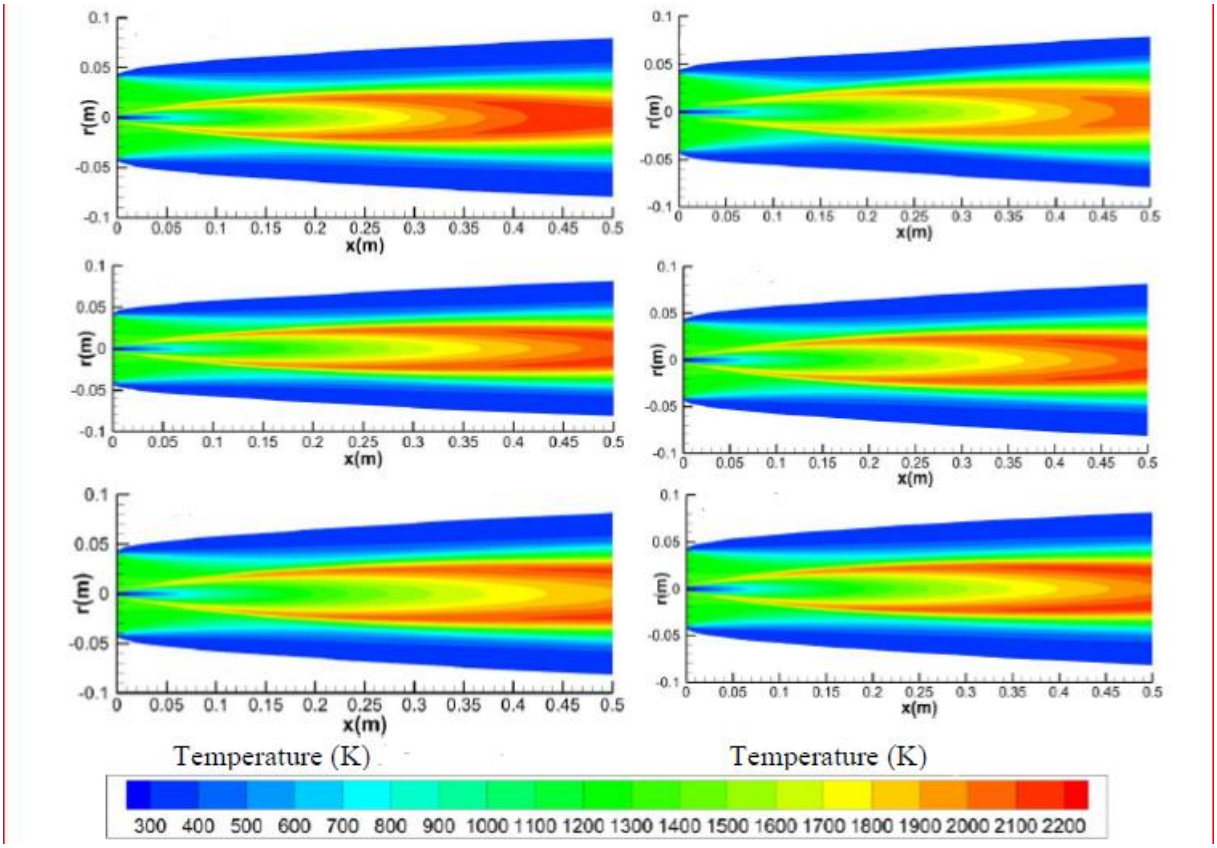

Fig.1. effect of adding Amonia on the countors of flame temeprature

Etude de l'influence de différents paramètres géométriques sur les pertes de charges en microcanal rugueuse

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Résumé

La rugosité de surface peut avoir un impact significatif sur les performances des microcanaux. Une étude déjà fait pour vérifier l'effet de la hauteur de rugosité, du pas de rugosité et de la séparation des canaux sur la chute de pression. Dans ce travail, on va faire une étude numérique tridimensionnelle d'un écoulement laminaire dans les microcanaux pour connaître le paramètre géométrique la plus affect sur les pertes de charges.

Entropy Generation Analysis for Optimal Working Fluid Selection in Minichannel Flat Plate Solar Collectors

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Abstract

Numerical simulations incorporating user-implemented algorithms in a parallel computing environment are performed using a finite volume computational fluid dynamics (CFD) model. These simulations analyze entropy generation and determine the optimal working fluid for minimizing irreversibilities in a minichannel flat plate solar collector (MFPC) under steady-state laminar convective flow conditions with solar radiation. Various nanofluids, including Al_2O_3-H_2O, CuO-H_2O, and Fe_3O_4-H_2O, as well as conventional fluids such as water and methanol, are investigated. The results conclusively reveal the CuO-H_2O nanofluid as the superior choice, exhibiting minimal entropy generation compared to other working fluids, thereby significantly improving heat transfer and reducing irreversibilities in the MFPC system.

Keywords: Entropy generation, Minichannel solar collector, irreversibility, nanofluid, solar radiation, computational fluid dynamics (CFD), Numerical simulation

Graphical Abstract

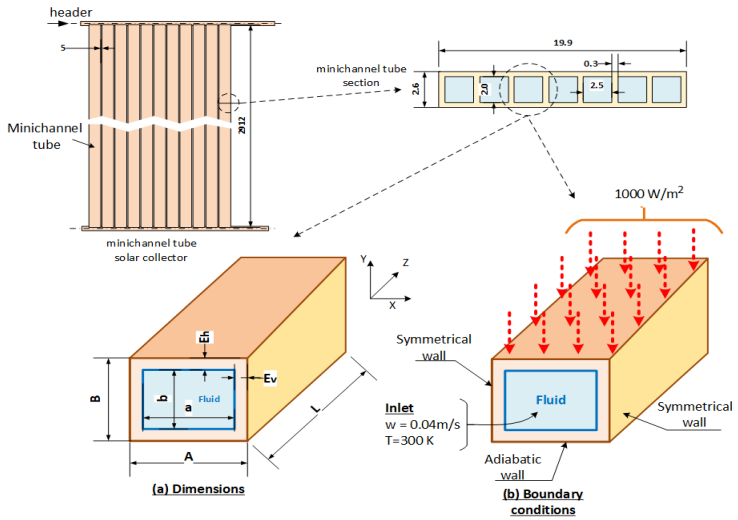

Fig. 1. Illustration drawings of the computational domain for a single rectangular minichannel. (a) Dimensions of the minichannel (b) Boundary conditions applied to the computational domain. for thermal analysis

Contribution a la modelisation numerique et analytique des transferts de chaleur en surface de la chaussee

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Résumé :

La prise en compte du contexte saharien devient indispensable dans la conception des chaussées. En effet, ces régions sont caractérisées par un contexte climatique spécifique, car les températures estivales sont très élevées. De plus le cycle quotidien des températures impose un différentiel des températures sous la forme de cycles jour-nuit avec un réchauffement-refroidissement très importants. Ces cycles de températures créent des déformations de types dilatations et contractions dans les matériaux en surface constituant la couche de roulement. Les déformations génèrent des contraintes verticales en tension compression et des contraintes horizontales en cisaillement dont le cumul cause la fatigue thermique de la couche.

Dans ce travail nous présentons deux modèles de calcul de profil de température en surface de la chaussée. Le premier consiste à l'élaboration d'un modèle numérique capable de simuler les différents modes de transfert thermique en surface de la chaussée, en utilisant le logiciel (Cas3M). Les entrées du modèle de données incluent des valeurs de rayonnement solaire, la température de l'air et la rosée température, ainsi que les valeurs journalières de vitesse du vent.

Le deuxième consiste à l'élaboration d'une approche analytique par le code Eurequa. Cette approche est capable de traiter le problème thermique transitoire incluant le phénomène de température ambiante et du flux solaire spécifiquement pour les régions arides où le ciel est souvent dégagé. Cette approche est adoptée car elle propose un calcul simplifié et rapide de la température de surface. Les modèles ont été testés expérimentalement sur la chaussée dotée par capteurs thermiques en laboratoire d'Egletons (France). Les résultats trouvés ont été satisfaisants et très encourageantes. La surface de la chaussée est soumise aux plus fortes variations de température, par conséquent, une bonne évaluation de la température de surface constitue un facteur clé pour une modélisation ultérieure de la fissuration thermique pour le calcul d'endommagement.

Mots clés : Chaussées, température, modélisation thermique, approches analytique, calcul transitoire,

Etude numérique de l'effet des nanofluides d'Al_2O_3 et de Cu sur le rendement d'un échangeur de chaleur tridimensionnel

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Résumé

L'étude numérique menée sous AnsysFluent, a pour objectif d'évaluer les effets de fraction volumiques de nanoparticules sur les propriétés thermo-physiques d'un échangeur tubulaire tridimensionnel. Les nanoparticules adoptées en suspension dans le fluide de base (l'eau) sont l'Al2O3 et le Cu. Pour réaliser cette étude, les fractions volumiques de nanoparticules considérées dans ce travail varient de 0 à 3%. Les résultats trouvés sont validés par les études antérieures puisqu'ils montrent que les nanoparticules de cuivre donnent le meilleur résultat.

Mots clés: Convection, Echangeur tubulaire, nanoparticules, nanofluide, CFD.

Résumé graphique :

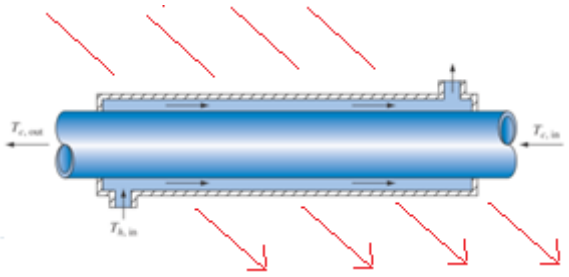

Fig.1. Transfert de chaleur en présence de fractions volumique de nanoparticules (Al2O3 ou Cu) dans un échangeur de chaleur tubulaire 3D.

Effect of flow regime on the location of paraffin deposition in pipelines

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Abstract

The problem of paraffin deposits in oil wells and pipelines monopolizes substantial human and economic resources. Its prediction is, therefore, essential to optimize its management.

The deposit formation arises from a delicate interplay of hydrodynamic, thermal, and thermodynamic factors, alongside paraffin diffusion and the rheology of the crude oil. This research has resulted in a better understanding and calculation of the rates at which wax is removed. Furthermore, the study has suggested the presence of two distinct flowing regions in turbulent and laminar flow, which results in the formation of thin solid sediments attached to the pipe wall.

By conducting this numerical study using FORTRAN, we can gain insights and optimize the design and operation of pipelines, and maintain efficient production. The study also involved a rough comparison between the results obtained from two different types of flow. This approach, which considers the viscoelastic behavior of paraffinic crude, allows for a more accurate prediction of deposit formation. With this enhanced understanding, we can develop improved strategies for managing paraffin build-up, minimizing resource allocation and costs associated with its removal. Ultimately, optimizing the design and operation of pipelines will contribute to the maintenance of efficient production in the oil industry.

Keywords – Wax deposition; paraffin; laminar and turbulent regimes

Graphical summary

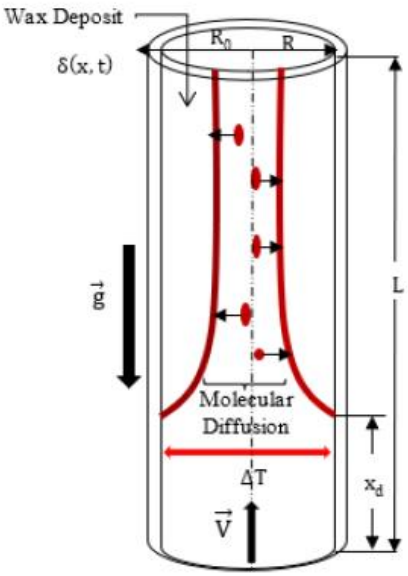

Fig.1. Wax deposition process in the hydrocarbon pipeline.***Erreur ! Source du renvoi introuvable.***

SEM microscopic study of the color change of EVA over the photovoltaic cell of a deteriorated solar panel and its effect on energy production.

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Abstract

While desert areas provide exceptional levels of solar radiation ideal for generating renewable electricity, harsh environmental conditions can accelerate the degradation of PV systems. The combination of extreme heat, UV rays, sand, and dust storms exposes solar panels and their components to significant thermal cycling and corrosive stresses. Over time, these factors can lead to issues such as delamination of coatings, microcracks in solar cell materials, and contamination of glass surfaces – all of which reduce the efficiency and production capacity of facilities.

Therefore, scanning electron microscopy (SEM) can provide valuable insights into the degradation mechanisms that affect the performance of old solar panels. One area of interest is discolouration of the ethylene vinyl acetate (EVA) coating covering photovoltaic cells. Through SEM analysis of cross-sections of deteriorated panels, we can observe changes in the microstructure and chemical composition of EVA as it turns yellow or brown over time due to exposure to UV radiation and thermal stresses. This color change reduces the amount of sunlight transmitted to the silicon solar cells underneath, hindering their power-producing capabilities. By correlating the degree of EVA color change with reduced power output, SEM studies can measure the effect of this degradation mode and guide strategies for improving the long-term durability of EVA encapsulation materials in future PV module designs.

Key Word : solar panels, PV systems, degradation, SEM , EVA.

Revolutionizing Renewable Energy by The Impact of Vector Flat-top Laser Beam Technologie

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Résumé

The emergence of vector laser beams has marked a significant shift in renewable energy technologies, offering a more precise focus due to their unique electric field polarization structures. This advancement not only improves the beam's focus but also broadens its application across scientific research and practical implementations. Vector laser beams are now at the forefront of research, driving progress in renewable energy by enabling higher resolution in microscopy for the development of solar panel materials and improving optical telecommunications for efficient energy management. This innovation highlights a new direction in enhancing the efficiency and integration of renewable energy sources, showcasing the role of advanced laser technology in moving towards more sustainable energy systems.

Building upon the discussion of vector laser beams pivotal role in renewable energy advancements, this document elucidates a groundbreaking development in beam technology the vector flat-top beam. Achieved through the incoherent overlay of two orthogonally polarized modes, namely horizontal and vertical polarizations, this innovation combines the foundational Gaussian beam with the first-order vortex Laguerre-Gaussian beam. Both modes are inherent to free space and, when synergized, produce a beam of exceptional characteristics. The vector flat-top beam distinguishes itself with a nearly consistent intensity across its propagation path and remains stable in lossless environments. This beam's uniform intensity and propagation stability mark a significant stride forward, promising to revolutionize various sectors by enabling cutting-edge applications, especially impact the manufacturing processes of solar panels, potentially increasing their efficiency and effectiveness. Moreover, this beam's capabilities could advance the development of new materials for renewable energy applications,

fostering innovations that enhance energy capture and storage mechanisms. This progression illustrates the significant impact that laser beam innovations, particularly the vector flat-top beam, can have on the renewable energy sector, promising to enhance various processes and materials crucial for the advancement of clean, sustainable energy solutions.

Mot clé: Vector laser beams; Renewable energy technologies; Advanced laser technology; Vector flat-top beam; Energy efficiency and integration.

Résumé graphique

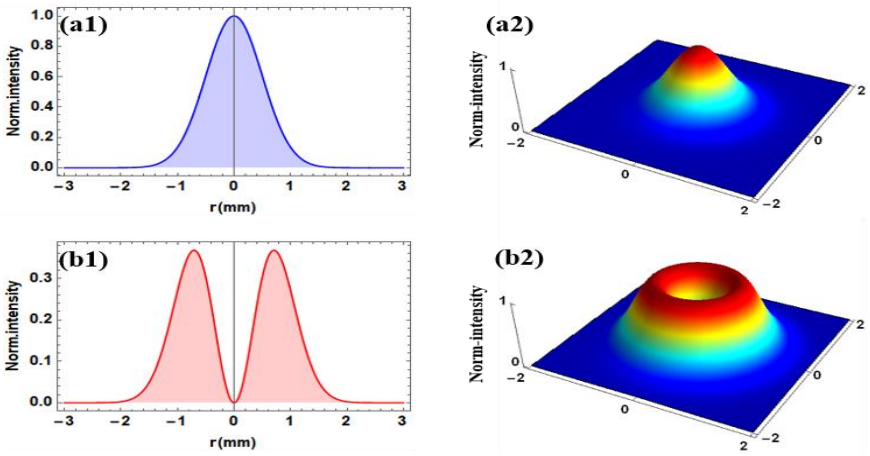

Fig.1. (a1-a2) Representation of intensity distribution along with a three-dimensional perspective of the fundamental Gaussian beam's intensity pattern; (b1-b2) Depiction of intensity distribution and a three-dimensional visualization of the first-order Laguerre-Gaussian beam's intensity profile.

An investigation into solar water heating systems for providing hot water in northern Algeria through

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Abstract

A solar water heating system harnesses renewable energy technology by utilizing the sun's energy to warm water for various purposes, including domestic, commercial, or industrial applications. The solar collector is the component within the system responsible for capturing solar energy and conveying it to the heat transfer fluid. There are two main types of solar collectors: flat-plate collectors and evacuated tube collectors. Flat-plate collectors are characterized by a flat absorber plate enclosed by glass on the upper side and insulated on the rear and sides. Tube collectors are composed of multiple glass tubes, each housing a metal absorber plate linked to a heat transfer fluid. The primary goal of this study is to assess the effectiveness and environmental consequences of two distinct solar water heating systems designed to meet the daily needs of a family comprising five individuals from October 1st, 2022, to March 31st, 2023. The flat-plate collector contributes 40% to the total energy requirement, whereas the second evacuated tube collector accounts for 44.32%. The thermal losses of these two systems represent 16.21% and 15.9%, respectively, compared to the total energy produced.

Keywords: Water heating, Solar Energy, flat-plate, Evacuated tube, Thermal losses.

Improving techno economic sustainable energy solutions: a deep dive into the newest methodologies for sizing hybrid energy systems using artificial intelligence methods

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Abstract

The increasing need for energy, in combination with growing environmental worries and the exhaustion of traditional energy sources, has led to a transition towards hybrid energy systems (HES). These systems combine renewable and non renewable sources to guarantee a power supply that is sustainable, dependable, and economically effective. The investigation of hybrid systems, which involve the incorporation of many energy technologies, is increasingly attracting attention as a solution to energy security, climate change, and rural electrification, with a special focus on developing countries. This comprehensive review aims to integrate findings from recent research studies on HESs , with a particular focus on design and optimization and control strategies, as well as economic and technical challenges. This paper aims to provide recommendations for future studies and research projects in the effective implementation of hybrid systems in diverse contexts, with a particular focus on remote and underserved areas. It achieves this by conducting a comparative analysis of the levelized cost of energy across different technologies and highlighting the importance of rules that reduce low carbon emissions. The results illustrate the necessity of developing comprehensive strategies that take into account not just the technical and economic factors, but also the environmental consequences. This will help achieve the worldwide objective of reducing carbon emissions and solve the immediate problems of climate change and energy availability.

Keywords: Best Size Wind Turbine ; PV System; Hybrid Energy System Metaheuristic Algorithms;

Double half-Heusler compounds: novel materials for energy applications

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Abstract

Using ab-initio calculations, we have studied the structural, mechanical, electronic, optical and thermoelectric properties of two double half-Heusler alloys ($Ti_2PdFeSb_2$, $Ti_2PdRuSb_2$). Our calculations predict stable non-magnetic semiconducting phases with indirect band gaps of 0.9eV for $Ti_2PdFeSb_2$ and 0.7eV for $Ti_2PdRuSb_2$. The calculated formation energies and elastic constants suggest that both alloys are thermodynamically as well as mechanically stable. A detailed thermoelectric response (S, κe, PF, ZT) of the alloys has been investigated using semi-classical Boltzmann transport theory as implemented in BoltzTraP2 code. The lattice thermal conductivity κL was evaluated through the Slack model and shows a maximum value of 9.46$Wm^{-1}K^{-1}$ for $Ti_2PdFeSb_2$ and 7.22$Wm^{-1}K^{-1}$ for $Ti_2PdFeSb_2$, at 900K. The collected results suggest that both compounds would be potential candidates for thermoelectric applications. By also analyzing the optical properties (dielectric function, optical conductivity, refractive index, absorption index and reflectance), our calculations suggest that both materials have high absorption coefficient and optical conductivity in the UV as well as visible region. The results make them potential candidates for the manufacture of photovoltaic devices.

Keywords : Double half-Heusler alloys, electronic properties, optoelectronic and thermoelectric devices, renewable energy.

Effect of using phase change materials (PCMs) in buildings to reduce the energy consumption

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Abstract

Incorporating phase change materials (PCMs) into residential roofing systems plays a pivotal role in optimizing energy management by ensuring substantial savings and enhancing indoor thermal comfort. The strategic integration of PCMs augments the thermal inertia of a building's envelope, effectively moderating heat transfer rates during peak thermal loads and stabilizing significant temperature fluctuations indoors. This not only enhances comfort but also significantly curtails energy consumption. The findings from the simulation, conducted using TRNSYS 18 on a detached house at the Applied Research Unit in Renewable Energies (URAER) in Ghardaïa, reveal that PCM with a melting point around 20°C is particularly efficacious in hot-dry climates, demonstrating notable summer cooling energy savings. The employment of this PCM culminated in a remarkable reduction of the annual energy consumption rate by 39.98%, underscoring the potential of PCM technology in sustainable building design.

Key words : PCM, energy savings, energy consumption, heating and cooling energy needs, TRNSYS type285.

L'efficacité énergétique de l'architecture vernaculaire : cas de la maison traditionnelle kabyle

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Résumé

L'objectif de cette présentation est de montrer comment l'architecture vernaculaire peut être une solution efficace pour améliorer l'efficacité énergétique des bâtiments, en prenant comme exemple la maison traditionnelle kabyle.

L'architecture vernaculaire se base sur les connaissances et les techniques transmises de génération en génération, adaptées aux contraintes climatiques et environnementales locales.

Dans le cas de la maison traditionnelle kabyle, plusieurs caractéristiques spécifiques contribuent à son efficacité énergétique.

Tout d'abord, les matériaux de construction utilisés sont souvent locaux et durables, tels que la pierre, la terre et le bois. Ces matériaux offrent une bonne isolation thermique, permettant de maintenir une température agréable à l'intérieur de la maison, tout en réduisant les besoins en chauffage ou en climatisation.

De plus, l'orientation des bâtiments est également un élément clé de l'efficacité énergétique. Les maisons kabyles sont généralement orientées de manière à profiter au maximum de l'ensoleillement, permettant ainsi de bénéficier de la chaleur naturelle du soleil pendant les périodes froides, tout en évitant une surchauffe pendant les périodes chaudes.

La ventilation naturelle est également un aspect important de l'architecture vernaculaire kabyle. Les maisons sont conçues de manière à favoriser la circulation de l'air, en utilisant des ouvertures stratégiquement placées pour permettre une ventilation naturelle et un rafraîchissement de l'intérieur.

Enfin, l'utilisation optimale des ressources locales est un autre aspect essentiel de l'efficacité énergétique dans l'architecture vernaculaire kabyle. Les habitants utilisent souvent des techniques traditionnelles pour collecter et stocker l'eau de pluie, ainsi que pour cultiver des jardins et des potagers, ce qui contribue à réduire leur dépendance aux ressources externes.

Elaboration and characterization of a Nickel-based catalyst supported on natural clay for the dry reforming of methane.

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Résumé

The search for efficient, less expensive and ecological materials for the dry reforming of methane is in perpetual evolution. Indeed, researchers are constantly trying to develop catalysts based on Nickel, a metal with a catalytic activity comparable to that of heavy metals but which is much cheaper due to its abundance in nature. However, Nickel-based catalysts suffer from rapid deactivation caused by Coke deposition and particle sintering at high temperatures and therefore significant loss of active phase. In addition, the large particles promote the deposition of coke which blocks the active sites. To remedy this problem, the researchers are trying to modulate the physicochemical properties of the catalyst by dispersing the active phase on catalytic supports having a sufficient specific surface and by adding promoters to have adequate surface properties.

In this work, the 15%Ni/Clay catalyst was developed and characterized by XRD, XPS, BET, and TPR-H_2. The catalyst was then tested in dry reforming of methane in a temperature range from 700 to 850°C under a reaction mixture of $20CH_4/20CO_2/60He$ with a total gas flow of 100mL/min with a step of 50°C/2H and a heating rate of 5°C/min. The catalytic activity was recorded during two continuous cycles, during the heating and cooling-down phases; to obtain information on the stability of the catalyst. The spent catalyst was characterized by XRD, Raman and SEM.

Mot clé : Dry reforming of methane- Nickel based catalysts- Natural Clay ; Coke deposition.

Préparation et Caractérisation d'un film biodégradable à base d'amidon de pomme de terre

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Résumé

L'objectif principal de ce travail est la valorisation de la biomasse par préparation du plastique biodégradable à base d'amidon des épluchures de pomme de terre et celui de pomme de terre, dont le but de palier l'utilisation des polymères traditionnels qui sont une source de pollution de l'environnement. Les films plastiques ont été facilement démoulés des plaques d'aluminium. Ils sont transparents ductiles et résistants.

Plusieurs paramètres ont été relevés par examen à l'œil nu, entre autres ; la taille, la couleur, la présence et/ou l'absence des impuretés, l'épaisseur, l'adhérence à la main ou l'aspect au toucher et la facilité du Bioplastique (la souplesse et la flexibilité). Différentes analyses ont été réalisés sur les différents échantillons pour l'évaluation de la qualité du produit, tels que l'analyse par FTIR, DRX, taux d'humidité et test de biodégradabilité.

Mot clé : Bioplastique – pomme de terre – épluchures– amidon – films plastique.

Role of defect density in absorber layer of CZTS solar cell

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Abstract

Fossil fuels have historically played a major role in meeting the world's energy needs due to their high energy density and widespread availability. However, their exploration poses many problems, hence the urgent need to explore and harness renewable energy sources, especially solar cell. Particularly, concerns regarding environmental protection have significantly spurred research in the field of photovoltaic conversion in recent years. Studies primarily focus on two areas. The first involves the development of high-efficiency photovoltaic cells. The second research axis aims at developing new processes and materials for the production of low-cost photovoltaic cells.

Several types of thin-film solar cells are gaining increasing attention due to their relatively cost-effective nature and efficiency in generating electricity. The absorbing layer CZTS (Cu2ZnSnSi4) is a promising material for solar cells due to its favorable optical and electrical properties. It has attracted considerable interest owing to its adjustable bandgap, which falls between 1.4 and 1.6 eV, and a high absorption coefficient surpassing 104 cm-1. The reported maximum efficiency for CZTS solar cells is approximately 11%.

Numerical simulation is considered a valuable technique for testing the efficiency of solar cells. It is carried out by solving the fundamental equations related to semiconductors. The investigation into the impact of defect density in the CZTS absorbing layer on (ITO/TiO2/CZTS/Mo) solar cell performance was carried out through numerical simulation using the AMPS1D simulator. The study is divided into two main parts. First, we investigate how the density of band-tail and Gaussian states within the Cu2ZnSnS4 layer influences the device figures of merit. Second, the impact of the neutral defect density in the CZTS layer on

the overall performance of the solar cell was examined. The device exhibits a strong degradation by increasing the defect density as a consequence of the SRH recombination mechanisms.

Si-based nanocomposites for Li-Ion battery anodes: Synthesis and Performance.

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Abstract

The use of Si as an anode in lithium-ion batteries represents a significant advancement in battery technology. This is attributed to Si exceptional capacity for energy storage, as it possesses a much higher theoretical capacity(3579 mAh g-1) compared to conventional materials used in anodes (graphite: 372 mAh g-1). The primary challenge associated with the silicon anode is to solve the destruction mechanism caused by the repeated increase in volume during the reaction with lithium.

Several strategies have been explored by researchers in this field to overcome the challenges arising from the silicon volume expansion during charge-discharge process, including: (1) the nanoscale Si with complex morphology has been widely investigated, (2) the multicomponent Si-alloys containing active Si embedded in inactive matrix phases. This method is advantageous by a dual function of the inactive matrix: accommodation of volume changes and providing a stable electronic conduction pathway during repeated alloying of Li with embedded Si. Unfortunately, reviews summarizing the work on Si-based alloys are scarce.

Manufacturing nanocomposites through mechanical alloying involves the process of grinding and blending elemental or compound powders together in a ball mill. This method facilitates the synthesis of various alloy compositions with controlled microstructures and properties. Mechanical alloying offers advantages such as scalability ease of operation, and the ability to produce a wide range of alloy types. In this study, we explored the process of manufacturing silicon-based alloys through ball milling, emphasizing the importance of this approach. Hence, the recent progress related to Si-based alloy anode materials is reviewed.

Geomechanics Analysis for Carbon Storage Project, Case Study of the Ahnet Basin Algeria

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Abstract

This work aims to investigate the safety and feasibility of a carbon storage project in the Ahnet basin, Algeria using an integrated geomechanical model. Through the analysis of stress orientation, present-day stress, and fault reactivation risk, we evaluate the suitability of the Silurian reservoir for carbon storage.

The role of geomechanics in carbon storage projects is crucial in ensuring the safety and effectiveness of the storage process. Geomechanics involves the study of how rocks and subsurface formations behave under stress and pressure. By analyzing the geomechanical properties of the storage site, such as rock strength, permeability, and stability, engineers can assess the feasibility and long-term viability of storing carbon dioxide underground (Fang et al., 2013). This information is important for site selection, design, and monitoring of carbon storage projects (Hardisty et al., 2011). Furthermore, geomechanics helps in understanding the potential risks and challenges associated with carbon storage, such as ground movement, induced seismicity, and leakage of CO2. Therefore, integrating geomechanical principles and practices into carbon storage projects can help mitigate these risks and ensure the successful implementation of carbon sequestration technologies.

As a result of the FMI logs within the study interval, we inferred the orientation of the horizontal injection drain as N 45°-N 225°. We used a poroelastic approach to estimate the stress regime. A 1.05 psi/ft gradient of overburden stress (Sv) has been obtained from density. Pore pressure has been estimated from the sonic log by a normal compaction trend, indicates a hydrostatic regime from the surface to the top of the Silurian unit with an average pore pressure

gradient of 0.43 psi/ft. The poroelastic approach under transverse isotropic vertical conditions (VTI) has been used to calculate the magnitudes. The outlines indicate a gradient close to 0.60 psi/ft of minimum horizontal stress, and 0.80 psi/ft for maximum horizontal. The stress magnitudes results, suggest a normal stress regime in the Ahnet Basin, which allows a good capacity storage for carbon. We study the risk of fault reactivation potential at two Silurian units (sand and hot shale) from the frictional theory analysis. According to the results, the sand unit are a good and safe way to store carbon as opposed to the hot shale unit, which is prone to fault reactivation due to increased pore pressure

Key words: Geomechanics, Ahnet Basin, Feasability, Carbon Storage, Reservoir.

Heat transfer study under the effect of a magnetic field in a wavy channel.

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Abstract

In this work, three-dimensional numerical simulation is used to examine the effects of a uniform external magnetic field on the thermal and hydrodynamic behaviour of ferrofluid flow in a wavy channel. The non-wavy portion of the channel is thermally insulating, but the wavy surfaces at the top and bottom of the channel are heated with a uniform heat flux. A regular magnetic field is applied along the direction of the main flow in the wavy part, in a direction perpendicular to the flow. The study investigates the effects of magnetic field strength, Reynolds number, and volume fraction on the thermal and hydrodynamic characteristics of the ferrofluid flow.The results indicate that the magnetic field has a greater effect on heat transfer at low Reynolds numbers (less than 400). The mean Nusselt number increases more than 80% with B=300 at a low Reynolds number (Re = 200).

Keywords: Transfert thermique convectif, nanofluides, champ magnétique.

Nano ZnO thin films synthesis by spin and dip coating method as a transparent layer for solar cell applications

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Abstract

Undoped and aluminum-doped ZnO thin films are prepared by the sol–gel process. Zinc acetate dihydrate, aluminum nitrate nonahydrate, ethanol and mono ethanolamine were employed as precursor, dopant, solvent and stabilizer. The multi thin layers are prepared by spin-coating on ultrasonically cleaned glass substrates, respectively. X-ray diffraction, UV-VIS, photoluminescence techniques were investigated for the characterization of the prepared AZO thin films. X-ray diffraction study show that all the films prepared in this work have hexagonal wurtzite structure, with a relative preferential orientation along the c-axis and the lattice parameters a = b = 3.260 Å, c = 5.214 Å. UV-VIS spectroscopy showed that the average value of the films transmittance in the visible region is found to be around 85 % and the gap ranges in the interval [3.15 eV–3.30 eV]. The photoluminescence spectrum only showed the UV peak while the broad band of the visible region was completely vanished.

Keywords: ZnO., XRD, Sol gel, Transmittance

Exploration des Frontières de l'Innovation Technologique dans l'Agriculture: Un Système d'Irrigation Écologique et Intelligente

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Abstract

Ce projet révolutionnaire propose le développement d'un système d'irrigation innovant visant à optimiser l'utilisation de l'eau tout en éliminant la nécessité de main-d'œuvre humaine. Trois capteurs stratégiquement positionnés orchestrent le processus d'irrigation, en surveillant de manière simultanée la température, l'humidité et la qualité de l'eau. L'utilisation du capteur DHT111 déclenche l'irrigation dès qu'une augmentation significative de ces paramètres est détectée.

Particulièrement remarquable, un capteur dédié à l'humidité du sol garantit une gestion proactive en cas de sécheresse. Lorsque nécessaire, une pompe automatique est activée pour fournir la quantité d'eau requise, assurant une irrigation précise et équilibrée. La conception ingénieuse inclut également un capteur de lumière pour ajuster l'arrosage en fonction des conditions météorologiques, permettant une utilisation optimale des ressources.

L'intégration d'un téléphone intelligent offre un contrôle centralisé, facilitant la surveillance et la gestion du système à distance. L'efficacité élevée de ce système, combinée à sa facilité d'utilisation via une application mobile, en fait une solution idéale pour les agriculteurs. De plus, la possibilité d'étendre le système pour inclure un plus grand nombre de plantes souligne sa polyvalence et son adaptabilité aux besoins agricoles variés.

En termes d'impacts positifs, ce projet va au-delà de la simple amélioration de l'efficacité de la consommation d'eau. Il contribue significativement à la préservation de l'environnement en minimisant la surconsommation d'eau, renforçant la sécurité alimentaire par l'augmentation de

la productivité agricole, et apportant des avantages économiques en réduisant les coûts d'irrigation et améliorant la rentabilité.

L'article suscite un intérêt particulier pour les lecteurs conscients des enjeux agricoles et environnementaux, offrant une solution pratique et innovante pour une gestion plus durable des ressources en eau.

Révolution technologique: La Maison Intelligente qui Transforme Votre Quotidien

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Abstract

L'article explore l'avènement de la maison intelligente, une conception innovante destinée à simplifier la vie quotidienne, renforcer la sécurité et optimiser la consommation énergétique. Cette révolution technologique intègre des dispositifs électroniques simples et des fonctionnalités novatrices, transformant l'expérience résidentielle.

Les caractéristiques de la maison intelligente incluent une porte d'entrée connectée à un système RFID, une cuisine équipée de capteurs de température et d'humidité contrôlés par Bluetooth, ainsi qu'un détecteur d'incendie relié à une alarme. De plus, un contrôle intelligent des lampes et de la porte de garage est accessible à distance via un téléphone intelligent.

L'article met en lumière les préoccupations actuelles liées à la consommation irrationnelle d'énergie, particulièrement en été, et souligne les enjeux de sécurité individuelle. Pour y répondre, la maison intelligente propose des solutions telles qu'un couloir doté d'un détecteur d'incendie connecté à une alarme, une cuisine équipée de capteurs de chaleur, d'humidité et de gaz, ainsi que des commandes automatisées des fenêtres, des ampoules et de la porte du garage, toutes gérées via Bluetooth.

Les avantages de cette innovation sont variés, englobant l'efficacité du système, l'amélioration de la sécurité et la réduction des coûts énergétiques. L'article met l'accent sur la préservation de l'environnement, présentant la maison intelligente comme une révolution technologique promettant un mode de vie plus intelligent, économe en énergie et respectueux de l'environnement.

Modelling of a PEM electrolyzer for hydrogen energy production: effects of operating conditions on process performance

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Résumé:

Researchers across various disciplines, including production, storage, and utilization, are increasingly drawn to hydrogen due to its renewable and eco-friendly nature, which holds the promise of replacing fossil fuels. Water electrolysis stands out as a method for generating hydrogen, involving the separation of water molecules into hydrogen and oxygen gases using direct electrical current DC, various technologies exist in this context, such as alkaline electrolyzers, PEM electrolyzers, and solid oxide electrolyzer cells. In this work, our focus lies on proton exchange membrane water electrolysis or polymer electrolyte membrane water electrolysis (PEMWE), indeed, PEM electrolyzer has the ability to be adjust swiftly with variable power inputs from renewable sources like wind and solar makes it suitable for coupling with these energy systems, its compact design, high efficiency and especially its rapid response time ensure this feature. In this work we aim to delve into how the PEM electrolyzer can be influenced by its operating conditions, which need to be deeply investigated especially when the electrolyzer is coupled with intermittent energy sources, as these operating conditions can significantly impact on the electrolyzer performance, energy consumption, and even its lifespan. Therefore, understanding and studying these factors in depth is essential, especially in the context of integrating electrolyzers with renewable energy sources.

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