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Ministry of Higher Education & Scientific Research
Directorate General for Scientific Research and Technological Development
Renewable Energy Development Center

Unit of Applied Research in Renewable Energies

6th International Symposium on New and Renewable Energies

October 13 - 14, 2021 Ghardaïa, Algeria

PROCEEDINGS

SIENR

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Preface

Objectives of the symposium

The objective of the sixth international symposium on new and renewable energy which will take place at the Unit of Applied Research in Renewable Energies of Ghardaïa (Renewable Energy Development Center, CDER) is to make an update on the progress of research work in the new energy field and renewable energies, with a special focus on their applications in southern Algeria areas. This high-level international scientific conference gathering which comes after the great success of the first, second, third, fourth, and five SIENR organized respectively by URAER in 2010, 2012, 2014, 2016 and 2018. This scientific meeting is intended to be a tradition to foster exchanges between researchers from different research centers and laboratories in renewable energies, industrialists and decision-makers working in this field.

Topics

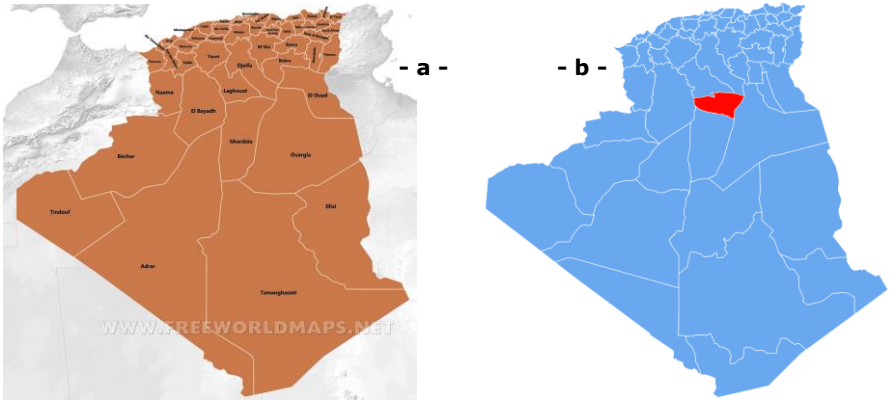
The main topics for this sixth international symposium are:

- Photovoltaic Solar and Hybrid Systems
- Thermal Solar
- New Energies (Hydrogen, Fuel cell ...)
- Renewable Resources (Solar, Wind, Biomass ...)
- Energetic Efficiency and Environment

Symposium venue

The sixth International Symposium on New and Renewable Energies SIENR20 is organized at the Applied Research Unit for Renewable Energies, which is located 20

km from the Ghardaïa city. Located in the Algerian Sahara, Ghardaïa city is in the heart of Algeria in the North of the Sahara Desert. It was issued from the country's administrative division in 1984. But since the creation of the new law, its geographical perimeter has become less broad and delimited by Laghouat in the North, El Djelfa in the North East, Ouargla in the East, El Meniaa in the South, and El-Bayadh in the West.



City's geographical location, old (a) and new (b) country's administrative division

Applied Research Unit for Renewable Energies
6th International Symposium on New and Renewable Energies SIENR20
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Summary

Plenary conferences		
Conference title	**Speakers**	
Energy Transition in Algeria : Challenges and Opportunities for a National Sustainable Energy System		Prof. Noureddine YASSAA Algeria's Commissariat for Renewable Energies and Energy Efficiency, CEREFE, Algeria
The Role of Renewable Energy in the Global Energy Transformation		Prof. Saad MEKHILEF Power Electronics and Renewable Energy Research Laboratory, PEARL, University of Malaya, Kuala Lumpur, Malaysia
Perovskite Solar Cells: R&D Challenges		Prof. Nouar TABET Physics Department, University of Sharjat, UAE
Probabilistic Forecasting of Solar and Windfarm Output		Prof. Jhon Boland, University of Austria

Communications : Theme A
Photovoltaic Solar and Hybrid Systems

Communications : Theme B
Thermal Solar

Communications : Themes C, D and E
New Energies (Hydrogen, Fuel cell ...), Renewable Resources (Solar, Wind, Biomass ...) and Energetic Efficiency and Environment

E16	Hydrogen production by dark fermentation	Sabah Menia, Ilyes Nouicer, Abdallah Khellaf	65
E17	DTC of DFIG included in a wind turbine connected to the grid	Slama abdelhamid, Hamouda Messaoud	66
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Theme A

Photovoltaic Solar and Hybrid Systems

Code : P01

Numerical simulation of graphene nano strip based heterogeneous solar cell to improve Voccell filling factor

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Abstract

In this paper, performance of heterogeneous solar cells was investigated by indium tin oxide (ITO) and graphene nano strip (GNS) on the performance of heterogeneous solar cells (HJ), namely GNS / c-Si, are investigated. By numerical simulations, this paper has shown that increasing the layer thickness (p) in GNS can not only improve the open circuit voltage (Voc) and the cell filling factor (FF). Based on the simulation we have proposed an explanation of this unexpected increase. Low-efficiency ITO deposition on (p) GNS actually leads to a decrease in the emitter (electron emission) of the cell, which in turn effectively increases its activation energy and its resistance affects the VOC and FF values. The results of this new insight guide us to further help optimize the HJ stack.

Keywords : Grapheme, Heterogeneous, Solar cell.

Code : P02

MPPT Charge regulator and monitor for photovoltaic / battery system based on microcontroller

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Abstract

Many different type of systems have been designed to adapt photovoltaic (PV) generators to their charges. They ranged from basic and low efficient linear controllers, to more sophisticated power electronic based converters. Accordingly, depending on the system requires, further attention should be devoted to the development of the converter design that connects the PV system to the battery (BAT) or load, in conjunction with adding new and more advanced control strategies to the system.
This paper outlines the process of designing a new electronic concept of a PV regulator for autonomous applications, which uses a buck converter to ensure high efficiency over a wide operating range. The power converter is driven by a very precise algorithm, adapted for implementation in a low-cost microcontroller (PIC184550), that has been designed to allow PV generator to track and function in their MPP including a control strategy that ensures an appropriate charging/discharging process for improved power management and prolonged life cycle of BAT. Besides, a software tool has been developed to supervise the various phases of the charging / discharging and the entire energy in the PV stand-alone system including the availability of continual telemetric monitoring of both PV and BAT units. The system has been developed and experimentally evaluated to investigate the behaviors of each unit of the isolated PV/BAT system.

Keywords : Microcontroller, Maximum power point (MPP), DC-DC converter, Battery charge control, Isolated photovoltaic systems.

Code : P03

A New method to represent the I-V and P-V characteristics of different photovoltaic modules

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Abstract

In this study, a new method to calculate the one diode model parameters able to correctly represent the I-V and P-V curves of photovoltaic modules is presented. The proposed method uses an iterative algorithm permits finding the appropriate value of the ideality factor and hence extracting the other parameters simply form datasheets information provided by manufacturers. The ability of the proposed model to calculate the current-voltage characteristics was examined by comparing the results with three other proposed methods in the literature for various photovoltaic technologies, such as polycrystalline, monocrystalline, Heterojunction photovoltaic modules.

Keywords : Photovoltaic, Modeling, I-V characteristics, One diode model, Parameters extraction.

Code : P04

Backstepping control for DC-Link voltage for a photovoltaic system connected to the grid through a Z-source inverter

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Abstract

This article is based on the contribution of using a Z-source converter in the photovoltaic energy conversion chain connected to the electrical network. For this, this subject deals with the modeling and simulation of this chain which consists of a Photovoltaic Generator (PV), Z-source converter, and the electrical grid. In order for the system to operate with good performance, a robust MPPT algorithm based on a Sliding Mode Controller (SMC) will be used to extract the maximum energy produced by the PV system and the Backstepping controller is also used to control the DC link voltage. A complete study of the dynamic behavior of the grid-connected PV system is presented using the software Matlab / Simpower system environment. The results show good performance in terms of efficiency and the quality of energy produced by the PV system connected to the electrical grid.

Keywords : Photovoltaic power source, Z-source inverter, Sliding mode control, Backstepping, Control maximum power point tracking.

Code : P05

Effect of a new smarts photovoltaic inverters connected with a distribution networks in Algeria

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Abstract

The distribution network of electrical energy, by its current structure, is not designed for the rising reception of solar photovoltaic (PV) array. Indeed, the insertion of a large number of PV systems induces overvoltage issues which, depending on the network load states, can lead to non-compliance with the admissible voltage values by the electrical grid code. In many countries, such as Algeria, it led to the revision of standards concerning the connection to the public distribution network of distributed renewable production. The new grid code requires flexible operation of the production plants which must be able to dynamically modify the active and reactive power according to the network parameters (i.e. the frequency and the local voltage of the network) on command local or by following external commands. Therefore, this work aims to study the use of an intelligent inverter in a critical photovoltaic installation, where relevant voltage fluctuations exist. A case study, with real network parameters monitoring data and measurements, is discussed in order to show how the "intelligent" functionalities of the new inverters can be implemented for the integration of PV installations in low voltage distribution networks.

Keywords : Low-voltage distribution network, Smart PV inverters, Common connection point, Measurements on electrical networks and PCC, Voltage variation.

Code : P06

Analysis study and modeling topologies of DC / DC converter with and without MPPT regulator in central grid connected in photovoltaic system

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Abstract

In this paper, we present analysis study and modeling topologies of DC / DC converter with and without MPPT regulator in central grid connected in photovoltaic system by using the maximum power point tracking efficiency of photovoltaic and modeling different topologies of DC / DC converter for photovoltaic application. It provides different improvements to the electrical architecture. This solar system represents the complete chain simulation in MATLAB / SIMULINK. Thus, we looking at the matching connection stage between the GPV, MPPT regulator, solar battery, circuit breaker. The new trends in this area are the use of economy solution by using renewable energy. In the central inverter topology which means that PV-panels are connected in one common array both in series and parallel that is connected to one large inverter. The result of PV array is connected to a single DC/DC converter. This topology has economical benefits as the number of the inverters is small, but the partial shadowing of one panel will affect on the whole array power output.We simulated and modeling topologies of DC / DC converter with and without MPPT regulator in central grid connected in photovoltaic system for the different conversion configurations in order to find the best one in terms of efficiency and energy produced.

Keywords : Photovoltaic generator, Maximum power point tracker MPPT, Performance, Power, DC-DC, DC-AC Converters.

Code : P07

A Novel single-input multi-port isolated bi-directional converter for renewable integrated EV applications

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Abstract

This paper proposes a novel Single Input Multi-Port Isolated Bi-Directional Converter (SIMP-IBDC) for renewable integrated electric vehicle applications. The proposed converter works under both PWM and single-phase control modulation. It has the advantages of the high-frequency transformer, which enables the step-up/down operation with extreme voltage gain. Besides, it offers low voltage regulation. In the proposed approach, converter integrated with solar PV, and maximum power from PV array is tracked by perturb and observe technique. The analysis, operating modes, and waveforms of the converter have been discussed in detail. The converter has an input voltage of 380V and an output voltage of 48V for each port. The simulation results are presented to validate the converter both in charging and discharging modes.

Keywords : Single input multi-port isolated bi-directional converter (SIMP-IBDC), Solar PV, dc-dc converters, Dual active bridge (DAB), V2G.

Code : P08

Comparison and analysis of five MPPT techniques for boost converter based PV system under real input deviations

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Abstract

In this paper, five maximum power point tracking (MPPT) strategies of photovoltaic (PV) system have been analyzed and simulated; Many MPPT algorithms have been extensively described in the scientific literature. However, this paper reviews the most frequently used as: the conventional Perturb and Observe strategy P&O , the differential P&O, the single referenced P&O, the double referenced P&O and the incremental conductance methods (INC) respectively ,The proposed method is based on a conventional variable step P&O strategy, which successfully recovers several drawbacks and limitations compared with other developed MPPT methods, mainly the oscillations around the MPP, the accuracy and the convergence speed under rapidly changing atmospheric conditions. To test the efficiency of the proposed method, a simulation model was developed, tested and analyzed effectively under matlab/Simulink environment considering several real scenarios of atmospheric conditions.

Keywords : Variable step size MPPT algorithm, P&O technique, Photovoltaic system, Accuracy of MPP.

Code : P09

Comparative study of models solar radiation in Sub-Saharan environment

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Abstract

The depletion of fossil and natural energy resources such as oil, gas and uranium is decreasing due to the current high consumption and the development of the industry in recent years. Climate change and pollution require a reflection on the energy need by a rapid transition to renewable energies. To cover energy needs, research is being conducted on renewable energy. One of the renewable energies which can fulfill the demand of the world until now, is solar energy, It is the direct source of generation of heat, light, and electricity and which is free and inexhaustible in most of regions of the world, this energy can be used in different ways, either in photovoltaic systems for the production of electricity, or in thermal systems for the production of hot water in the housing sector.
In this article we will do a comparative study. One consists in determining the two empirical models (Davies & Hay and Ashrae) which will allow us to estimate the daily irradiations on a horizontal plane, and on the other hand we compare it by the results measured in the site of Adrar at the time of four seasons. A comparative study of the results obtained by simulation of the two models showed that the Ashrae model gives a better estimate of the global solar components, the absolute mean error does not exceed 6% and the correlation coefficient was greater than 0.97, as did the relative coefficient of the bias error does not exceed 5% in absolute value, relative RMSE does not exceed 9%.

Keywords : Solar radiation, Adrar, Davies & Hay, Ashrae, Irradiation.

Code : P10

Comparison study between conventional and advanced MPPT based on fuzzy logic and ANFIS for standalone system

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Abstract

This paper provides a comparative Study between conventional P&O and advanced Maximum power point tracking (MPPT) algorithms based on fuzzy logic control (FLC) and Adaptive Neuro-Fuzzy Inference System (ANFIS) for standalone application. In order to achieve the operating point, the proposed MPPT techniques control the duty cycle of a DC-DC converter which interfaces the load and the PV generator. The conventional P&O algorithm is discussed due to its simplicity and low implementation cost but its dynamic behavior is considered worst especially in rapid irradiation changes. Hence, FLC and ANFIS are supposed to perform better in term of power ripples elimination and the tracking accuracy. However, simulations results have been recorded by using Matlab/Simulink. These results prove the privilege of the advanced techniques over conventional algorithm.

Keywords : Component, Formatting, ANFIS, MPPT, Fuzzy Logic, P&O, PV system

Code : P11

Solar photovoltaic and wind hybrid energy systems for optimization techniques and cost analysis

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Abstract

Off-grid hybrid energy systems (HES) have become more cost-effective and reliable than single-source systems for the electrification of rural areas. This paper presents a techno-economic analysis of a wind/PV hybrid system for a 40 rural houses the region Adrar (27.59°N, 0.11°W) of Algeria One year recorded wind speed and solar radiation are used for the design of a hybrid energy system. Average annual wind speed in Adrar is 7 m/s and annual average solar energy resource available is 8 kWh/m²/day. Energy which is produced by wind/PV hybrid system in a course of one year is 5649kWh/year, wind turbine produced 2411 kWh/year (20%) energy, and PV generator produced 80 % (4498 kWh/year) energy. From economical analysis, it was found that wind/PV hybrid system's cost of a unit of electrical energy in Adrar with 12% yearly discount is 0.6 $/kWh.

Keywords : Techno-economics analysis, Wind/PV, Hybrid system, Electrical load

Code : P12

Numerical study of the hybrid photovoltaic thermal collector with ribs

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Abstract

The thermal photovoltaic hybrid solar collector is a useful device that can be used to increase the heat transfer fluid temperature by extracting the heat from the stored solar energy that is not converter by the solar cells in electricity. In this work, a two-dimensional numerical study of the turbulent mixed convection in the hybrid system PV/T, which consists of photovoltaic monocrystalline PV cells and a rectangular ribbed Aluminum duct in contact with the lower surface of the PV module, for analyzed the effects of the Reynolds number (in range 4000-20000) and the ribs shapes on flow structure and improvement of the heat transfer rate has been carried out. A comparison was made between the shapes of the ribs arranged according to the angel β with three configurations (square for $\beta=90°$, triangle for $\beta=45°$ and $45°<\beta<90°$). The results show that the optimum angle of inclination of the rib for good cooling of the PV cells and for high performance of the system is 78°. These results can be used for efficient and optimal design of hybrid PV/T water solar collectors.

Keywords : Heat transfer rate, Hybrid solar collector, Ribs, Turbulent natural convection, Photovoltaics.

Code : P13

Solar inverter performance prediction

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Abstract

Based on the outdoor PV system of the Renewable Energy Development Center (CDER) at the height of Algiers the instantaneous inverter efficiency under field conditions has been analyzed and compared to measured data.
A model is developed that expresses the inverter efficiency as a function of the inverter AC output power. A general efficiency curve is extracted for different SMA/ Sunny Boy 3000TL invertersby applying multi-exponential approximation function. Model parameters are calculated using field data. The model is used to predict inverter efficiencies for different periods of time and compared to the measured ones.

Keywords : PV systems, Grid connected PV inverters, PV inverter electrical conversion efficiency, Inverter efficiency modeling, Double-exponential curve fitting.

Code : P14

Simulation of high-efficiency perovskite-based tandem solar cells

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Abstract

The single-junction solar cells suffer from transmission and thermalization loss. Tandem solar cells are a promising development of solar cells, as they can solve the main limitation of which the single-junction solar cells suffer. Tandem solar cells consist of two or more junctions with different energy gaps that absorb a broader spectrum and show higher efficiency. The simulation of $MAPbI_{3-x}Cl_x$/Si and $MAPbI_{3-x}Cl_x$/CIGS have been presented. An optimized perovskite $MAPbI_3$-xClx top subcell is used, which enhanced the overall performance of the proposed tandem cells. The efficiency of the $MAPbI_3$-xClx/Si tandem cell approaches 30.18%. An increase in the efficiency of 33.38% is reported for replacing the bottom subcell by CIGS instead of silicon, with the same doping level. SCAPS-1D simulation tool was used to test the performance of the designed tandem cells. The comparison of the proposed tandem cells to the recently published work shows a promising performance and higher efficiencies.

Keywords : CIGS, Perovskite, SCAPS-1D, Si, Tandem solar cell.

Code : P15

Incremental conductance algorithm based on indirect control mode using an integrator controller tuned by routh criterion

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Abstract

Due to its simplicity and low cost of realization, the incremental conductance algorithm (INC-algorithm) is still attracting the interest of the research community. This algorithm with direct control mode where the duty cycle is provided directly can present some drawbacks, such as: 1) oscillation around the maximum power point (MPP) when the step size used to update the duty cycle is large, 2) imperfect maximum power point tracking when the step size is small. To avoid these limitations, the INC-algorithm based on indirect control mode is proposed. The proposed algorithm consists of two stages; the first one is used for the reference PV-module-voltage searching; and the second one is used for the stabilization of the PV-module-voltage control loop via an integrator. To ensure high performance against load variation and variable climatic condition, the Routh criterion is employed to determine the range of the integrator gain. Simulation results confirm the superiority of the proposed INC-algorithm based on indirect control mode over the classical one based on direct control mode.

Keywords : PV-module, Boost converter, INC-algorithm, Direct control mode, Indirect control mode.

Code : P16

A Numerical approach of three hybrid systems based on photovoltaic /thermal (PV/T) air solar collector

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Abstract

The present work aimed to enhance the heat transfer rate of two-panel surface temperatures through passive air-cooling. A comparison of three modes alternatively cooled from the front side (PV/T-I), from the backside (PV/T-II), and from both sides (PV/T-III), to improve the heat transfer by laminar natural convection of a hybrid system PV/T air collector. A numerical simulation was developed to solve the continuity, momentum, and energy equations by using the finite volume method. The modified Rayleigh numbers affect the heat transfer rate, whose values ranged between $10<Ra^*<1000$ was analysed. The obtained numerical results have been validated with previous experimental work, and the best agreement has been found. The current numerical results show that the mode (PV/T-III) of double-pass has a better heat transfer rate than other modes by about 111% compared to the first mode (PV/T-I). Correlations equations of the average Nusselt numbers were presented.

Keywords : Finite volume method, PV/T air collector, Heat transfer enhancement, Passive air cooling.

Code : P17

Comparison and experimental tests between conventional and interleaved DC/DC boost converter topology

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Abstract

This paper deals with interleaved boost converter design for a stand-alone photovoltaic (PV) system.Accordingly, the correct design of the battery charge Controller is a crucial task. In this context, a comparaisonbetween conventional and interleaved boost converter is provided based on experimental test, in which a high output current gain with lower output power ripples and higher efficiency requirements are achieved. In addition, the control of the Pulse Width Modulated (PWM) signal offset of the interleaved boost converters is provided using the Digital Signal Processor (DSP) TMS320F28335 Texas Instrument interfaced with Matlab software. The obtained results can serve for designing a battery charge controller operation in autonomous PV system.

Keywords : Charge controller, PWM control, Boost converter, Interleaved boost converter, DSP TMS320F28335.

Code : P18

End of life silicon based photovoltaic panels: A review

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Abstract

Solar energy is a clean renewable energy source. During the electricity production, photovoltaic systems don't generate any waste or toxic emissions. However, if this industry is to truly present a sustainable solution it must account for the photovoltaic solar panels' end-of-life phase.
According to the already installed PV panels and its predicted growth, the amount of waste PV panel is estimated to reach in 2050, 78 million tons.
Different researches showed the necessity to recover the photovoltaic waste panels and according to the last issue guideline of the European Union (2012/19/EU), the end of life photovoltaic panels are considered as electronic and electric equipment waste.
In this review paper, different recent researches interest of recycling photovoltaic panels will be cited.
The several components which constitute silicon based photovoltaic panels will be presented. These silicon based photovoltaic panels presented are realizing in researcher center of technology of semiconductor for energetic (CRTSE, Algeria).
The materials present in the panels can be recovered and reused using specific methods; once their modules reach the end of their life cycle such as: glass and aluminum, as well as semiconductor materials such as silicon, copper, indium, cadmium and tellurium.
Finally, we will cite 53 different recycling panels industries.

Keywords : Recycling, Photovoltaic panels, Silicon, End of life, Recycling panels industries

Code : P19

A Clustering event detection approach for non-intrusive load monitoring

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Abstract

Non-intrusive load monitoring (NILM) aims to estimate the energy consumption of individual appliances from the aggregate power signal. Studies have shown that giving similar feedback to energy users can result in significant energy savings. Existing NILM methods can be grouped into event-based and eventless methods. Currently, most of the existing methods are event-based NILM methods. Such approaches require an event detection step to extract the necessary features for model development. In this work, we present a NILM event detection method based on data clustering. In this method, we combine the results obtained from data clustering with a rule-based approach to extract events from the aggregate power signal.
We experimented with three different state-of-the-art clustering algorithms and tested our method on a publically available dataset.
The several components which constitute silicon based photovoltaic panels will be presented. These silicon based photovoltaic panels presented are realizing in researcher center of technology of semiconductor for energetic (CRTSE, Algeria).
The materials present in the panels can be recovered and reused using specific methods; once their modules reach the end of their life cycle such as: glass and aluminum, as well as semiconductor materials such as silicon, copper, indium, cadmium and tellurium.
Finally, we will cite 53 different recycling panels industries.

Keywords : NILM, Event detection, Clustering, K-means

Code : P20

Comparison of nanocrystalline silicon and nanocrystalline silicon carbide window layers

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Abstract

The higher electric and optical properties of nanomaterials give an opportunity for solar cells to get better efficiencies. nanocrystalline hydrogenated silicon (nc-Si: H) and nanocrystalline silicon carbide (nc-SiC: H) thin films offer a new range of specialized solar photovoltaic (PV) nanostructured materials. Because of their wide band gap nature, they are utilised as a window layer for thin-film a-Si:H-based solar cells. The question whether nanocrystalline hydrogenated silicon (nc-Si:H) or nanocrystalline silicon carbide (nc-SiC:H) is more adapted for window layer in amorphous silicon solar cells, was investigated in this work using AMPS-1D simulator. Our simulations agreed well with experiments and showed that incorporating a boron doped nanocrystalline silicon carbide window layer instead of nanocrystalline silicon enhances the device performances. Moreover, the use of this material in pin-junction produced photovoltaic cell with efficiency of 9.2%, with VOC = 0.867V, JSC = 14.7 mA/cm2 and FF = 72.4%.

Keywords : AMPS-1D, nc-SiC:H, nc-Si:H, Window layer, Buffer layer.

Code : P21

A Novel Hybrid Model for PV Power Forecasting Using Support Vector Machine and Grasshopper Optimization Algorithm: Case Study

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Abstract

Photovoltaic (PV) installations have the potential to deliver significant economic and environmental advantages to electric networks. On the other side, when PV penetration rates rise, the unpredictability of the solar source presents a particular problem in grid management. In this respect, PV power forecasting is an important tool for managing uncertainty and ensuring system stability. In the current work, we present a novel hybrid model for intra-hour forecasting of PV power output. The proposed hybridization mechanism performs on training the Least Squares-Support Vector Machine (LS-SVM) model through Grasshopper Optimization Algorithm (GOA) using PV power measured from 01-01-2016 to 31-12-2017 in half-hourly scale. GOA is developed for hyper-parameters tuning for LSSVM model for improving its forecasting performance. The forecasting performance of the proposed GOA-LS-SVM is evaluated and validated on a database of two years for one halfhour forecasting ahead. The proposed forecasting model benefit only from previous PV power output, in particular, the last eight PV power are used as input to the GOA -LA-SVM model. To demonstrate the effectiveness of the proposed model we test its forecasting ability against Extreme Learning Machine (ELM) for different sizes of training data. The proposed GOA -LS-SVM predicts PV power output with acceptable performance compared to the ELM mode

Keywords: Photovoltaic Power, Forecasting, Solar Energy

Theme B

Thermal Solar

Code : T01

The Exploitation of Solar Energy to Elaborate Zinc Oxide Thin films

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Abstract

In industry, the most used energy sources are of non-renewable origin such as oil and natural gas, unlike renewable energy sources "sun..." which their uses remain limited. Among these industries, there is the domain of electronic components manufacturing such as deposition of thin films (photovoltaic cells, sensors ...etc.), in which, electric furnaces are generally used to heat substrates.

The aim of this work is to elaborate ZnO thin films with different molarities (0.05 - 0.15M) on glass substrates, using spray pyrolysis technique coupled with solar heating mode (renewable energy) in order to replace conventional heating methods (electric,..etc.) used inside laboratories, which are expensive and present certain dangers. In order to achieve this goal, we used a system of solar furnace to heat the glass substrates.

At last, the elaborated films have been characterized using X-ray diffractometer, UV-vis spectrophotometer and four-point method in order to assess the reliability of realized solar spraying dispositif.

Keywords : solar furnace, thin film, spray pyrolysis.

Code : T02

Mathematical model of the energy balance for two configurations of trapezoidal box-type solar cooker tested under Saharan climate

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Abstract

This article presents a mathematical model for two configurations of a box type solar cooker with trapezoidal shape: the cooker will be eqquiped with an additional reflector at first time and will be removed later, the aim is to determine the behavior in both cases depending on the the available solar energy. The energy balance equations have been solved by a Matlab program developed for this purpose. To validate the mathematical model, the values of the theoretical temperatures values were compared with the experimental results obtained from cooker tests carried out under the Saharan climatic conditions of the Ghardaïa site. The tests were carried out with the cooker filled with one or two liters of water from 9:00 AM. to 5:00 PM. A good agreement was found between the measured values and that estimated by the proposed model. The model was then used to simulate the performance of the solar cooker throughout the national territory. Several temperature maps were obtained for different days of the year (winter and summer). It has been found that the temperatures obtained when the cooker is fitted with its reflector are much higher than that obtained without a reflector. The large area of Algeria allows the operation of the cooker without or with reflector in different locations and in particular months for each one of the configurations depending on the amount of solar energy received.

Keywords : Solar radiation, Mathematical model, Thermal behavior, Solar cooker

Code : T03

Study and simulation of the thermal behaviour of a box solar cooker using comsol multiphysics software and its experimental validation under Ghardaïa climate

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Abstract

In order to study the thermal performance of a solar cooker used for food cooking, we conducted an experimental and numerical study to examine the temperature distribution and profiles of a prototype of box type solar cooker realized by the small thermodynamic power plants of Applied Research Unit in Renewable Energies (URAER, Ghardaïa). The numerical simulation takes into account the initial conditions, the weather conditions and the boundary conditions. The water temperature values in the pot and on the absorber plate were obtained by the Comsol software. The experimental tests (stagnation and sensible heating tests) were carried out under the climatic conditions of the Ghardaïa city (located at a latitude of 32.39°, a longitude of 3.78° and an altitude of 463m at sea level). The tests were carried out on a clear days in a summer month under global solar radiation received on a horizontal surface varying between 800 and 1000 W/m² and an ambient temperature varying from 28 to 30 °C. The experimental results and those of the simulation are compared and analyzed.

Keywords : Solar radiation, Comsol software, Box solar cooker, Numerical simulation, Thermal profils.

Code : T04

Passive and active concepts for energy efficient buildings

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Abstract

The present research focuses on the diagnosis and improvement of the energy efficiency of an energy-intensive house. For this purpose, passive and active concepts were applied to a house located in a remote site in the Ghardaïa region. The aim is to reduce the energy requirements for heating and air conditioning so as to make this habitat more energy efficient. Indeed, thermal insulation is considered as an effective and reliable solution to improve the energy efficiency of buildings. By combining the main energy concepts (thermal insulation, passive solar heating, compactness, PV system of 470 Wc, solar water heater of 200 liters capacity), it is possible to reduce the total energy needs to 77.4% compared to the energy consumption of an energy-intensive house.

Keywords : Energy-intensive house, Passive and active concepts, Low consumption house, Thermal insulation

Code : T05

Geothermal and thermal waters in the Ghardaïa region

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Abstract

The presence of thermal waters in the region of Ghardaïa, whose temperature is 41,5 °C to Zelfana and 40 °C to Guerrara respectively, will lead us to determine the thermal characteristics of the study region (wilaya of Ghardaïa). We would be interested in particular, mapping the geothermal gradient and temperature map at the roof of the Continental Intercalary aquifer.
Geostatistical modeling based on Universal kriging has been used for the mapping, which has use data of 58 oil well. Universal kriging was used to estimate geothermal gradient variation in the study area. Data from 58 petroleum wells from 136 were used for mapping, including the value of geothermal gradient and thermal conductivity of which are averaged relative to the length of well.

Keywords : Thermal, Continental Intercalary, aquifer, Geostatistical, Ghardaïa

Code : T06

3D Approach by the RANS method of convective transfer and flow in a room heated by a solar energy

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Abstract

In this present work, 3D numerical simulations are carried out to determine the fields of velocities and temperatures in a passive room, the basic equations which govern heat transfer and flow are those of the energy and Navier-Stocks aquations, written in Reynolds decompositions. The results show the existence of a compromise between heat transfer and airflow in this system. The thermal and dynamic behavior is characterized by the determination of the local Nusselt number on the one hand and by the local Grashof number on the other hand.

Keywords : Convection, Flow, RANS models, CFD modeling.

Code : T07

Thermal performance of fresnel solar concentrator: An experimental analysis

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Abstract

The Linear Fresnel power technology attracted specific attention these last few decades. Accordingly, the present work focuses on an experimental study of a prototype using a Fresnel type concentrator. Theoretical analysis and experimental validation are carried out to improve the thermal performance of this concentrator. During the test, various measuring instruments and parameters presented in curves form are required. Specifically: the inlet temperature of water to the absorber tube, the outlet temperature, and the additional water flow. To this end, theoretical and measured values are analysed, compared and validated. Consistent with the obtained results, the Fresnel reflector shows its features in different applications, i.e. heat and electricity production for thermal powers reaching 250 KW, and daily efficiency of above 40%.

Keywords : Solar concentration, Fresnel concentrator, Performance, Thermal power

Code : T08

Improvement of the thermal comfort of building roofs equipped with a phase change materials (PCM) layer under desert weather conditions

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Abstract

In single-story buildings, the roof is the section of the building that receives the most sunlight and hence heat in the summer, making shading difficult. As a result, it is critical to limit this gain by careful design and construction, whether through the shade, insulation, or thermal mass.

The use of phase change materials (PCM) in buildings helps to reduce energy reliance by allowing for the use of latent heat storage to enhance thermal inertia without increasing the building's weight considerably.

The incorporation of MCP into a building's structure has the potential to increase the thermal inertia of its envelope, which could not only slow down heat transfer rates during peak hours but also reduce the fluctuations of relatively large indoor temperatures, improving thermal comfort and lowering energy consumption.

The proposed study is based on the simulation of a detached house located at the Applied Research Unit in Renewable Energies (URAER) Ghardaïa under weather conditions corresponding to the year 2018.

Simulation findings revealed that the total energy demand has decreased by up to 20% with PCM. Also, it is shown that the best way to incorporating a PCM layer in the roof and that by placing it in the inner facade of a roof with less thickness consideration because the latter can be counterproductive during the cold season.

Keywords : Building, PCM, Roof, Thickness, TRNSYS, Temperature, Energy consumption

Code : T09

Exploitation of solar energy for the elaboration of zinc oxide thin films according to a new method of solar spray pyrolysis

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Abstract

The deposition of thin films is done by several methods such as physical process (PVD), chemical process (CVD), spray pyrolysis is part of these methodes, where heat is required as the main factor, in this work we used the sun as a source of heat. For this purpose a parabolic concentration system was used, which offers the possibility to produce heat from solar energy, where temperatures can easily exceed 800 °C and the conversion efficiency is high generally. By exploiting direct solar radiation, considered the main resource, which is very considerable on a planetary scale, this technology offers a real alternative to the consumption of fossil resources with a low environmental impact and a strong potential for cost reduction. The parabolic geometry of this device allows all the light rays falling on the surface of the parabola to be concentrated in one point where the cooking dish is placed (focus). The power of this device depends of course on the size of the parabola. The elaboration of the thin layers based on zinc oxide is done at well determined conditions, allows these conditions the temperature, where it is chosen at400 C°. for that, a geometrical study on the parabolic solar concentrators was made to determine the various parameters which allow to wait for this temperature with the solar radiation of 950 W/m².after the dimensioning of the concentrator one elaborated a series of ZnO to see their effectiveness.

Keywords : Thin film, Solar energy, Parabolic solar concentrator, Solar radiation

Code : T10

Comparative study between photovoltaic and thermal solar cooling

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Abstract

In recent years, research on thermal comfort in the building sector has increasingly focused on renewable energy as an alternative energy. TRNSYS software is used for modeling two types of air conditioning systems. A photovoltaic wage air conditioning system that refers to all air conditioning techniques using electricity produced by photovoltaic panels. The second thermal energy absorption system produced by a vacuum tube solar sensor. In this work, were compared the performance of solar thermal air conditioning and solar photovoltaic air conditioning under the influence of a different conditions, temperature, surface area, auxiliary energy, yield, ring fraction and cost. The results shows that the total energy consumed in the mechanical compression system is very high and up to 170%, compared to the absorption system during the hot season.

Keywords : Cooling, Solar thermal, Solar photovoltaic, Absorption.

Code : T11

Development of an ANN model for forecasting time series of cooling performances in CSP plants- Solar tower power plant (Gemasolar) as a case study

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Abstract

Unlike conventional thermal power plants which are generally erected in the coastal regions near water bodies, seas and oceans, where water resource availability is not a critical factor, concentrating solar power (CSP) plants are usually installed in high sunny zones which generally characterized by semi-arid and arid climates, where water resources are hard to find and/or to employ. This from a side, on the other side, the hourly simulations of cooling performances in CSP plants, including power required for cooling and water consumption, are very complex and require many calculations, data analysis and time consuming. Therefore, the aim of this paper is to develop an artificial neural network (ANN) model to estimate the hourly cooling performances of a solar thermal power plant based on its hourly generated power, ambient temperature and wind speed. In this regard, the commercial power plant Gemasolarwith solar tower technology has been chosen to perform the study. The obtained results of the statistical analysis show that ANN can be used as a good option to forecastthese two parameters in a large-scale solar tower power plant without passing through detailed modelling. However, it should be pointed out that this model can be only used for plants that are simulated in locations with similar meteorological conditions and solar resources as the site where this study has been performed.

Keywords : Artificial neural network, Solar tower power, Gemasolar, Statistical analysis, Cooling performances.

Code : T12

Experimental test procedures for thermal performance evaluation and parameters determination of a parabolic concentrator type solar cooker

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Abstract

In Algeria, harvesting of wood for cooking causes its exhaustion and accentuates more the problem of the scarcity of this resource causing deforestation and leads to disastrous consequences on the ecosystem. On the other hand, the use of conventional energy sources leads to serious environmental problems. Solar energy is responsible for the so-called group of renewable energy sources, which is the most important. As part of this work, we will discuss about the use of solar energy for cooking using a parabolic solar cooker (PSC).

The need to normalize and evaluate a solar cooker and compare different designs calls for testing procedures, which represent their respective thermal performance. The testing procedure followed for concentrating solar cookers presently consists of determination of the time required for sensible heating of a known quantity of water up to the boiling point. A test procedure to evaluate the thermal performance of these types of cookers has been proposed by Mullick et al., in which, it gives the thermal performance in terms of the heat loss factor and optical efficiency factor. In addition, a test method of solar cookers has also been suggested by Funk in year 2000, in which the performance is given by two parameters, namely, adjusted cooking power and overall heat loss coefficient.

The parabolic solar cooker is designed and realized at the Applied Research Unit in Renewable Energy (URAER) of Ghardaïa, according to international norms and standards. Different tests were carried out under various climatic

conditions to assess the thermal performance of the cooker through the profiles of the water temperatures measured at the level of the cooker, which will allow to examine the feasibility of cooking with this kind of cookers in South Algeria.

Keywords : Solar energy, Paraboloid concentrator type solar cooker, Experimentation and tests, Heat loss factor, Optical efficiency.

Theme C

New Energies
Hydrogen, Fuel cell...

Theme D

Renewable Resources
Solar, Wind, Biomass...

Theme E

Energetic Efficiency and Environment

Code : E01

The drying kinetics of apricots undergo steam blanching in a microwave oven

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Abstract

This study aims to determine the influence of drying apricots undergoing a steam blanching treatment by microwave oven at different powers (200, 400 and 800 W). In order to market a product of good nutritional quality (sugar content, polyphenol content and mineral salt content), limit the imports of dried fruit abroad, encourage local products, increase the shelf life of the studied fruit and obtain apricot-based foodstuffs in four seasons. The drying process was carried out between 270 and 510 s, depending on the power level of the microwave oven. Several literature models are used to simulate the drying kinetics of dried apricots. The modified Henderson & Pabis and Henderson-Pabis models were considered to be the best experimental drying curves for apricots undergo steam blanching.

Keywords : Microwave, Steam blanching, Kinetics.

Code : E02

Design and Implementation of currents-sensors faults diagnosis by equivalent output error injection of Sliding-Mode for PMSG-based WECS

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Abstract

The performances of wind energy conversion systems (WECS) depend strongly on the current measurement accuracy. Therefore, the current sensor errors can lead to high degradation in performances and stability of the system. In order to avoid the aforementioned demerits, a method of detecting, identifying and isolation of sensors errors has been proposed in this paper. The proposed method is mainly based on identification and isolation of currents sensors faults of a permanent magnet synchronous generator (PMSG) based wind turbine, using the equivalent output error injection of sliding mode observer (SMO). In this work a linear matrix inequality (LMI) is used to minimize the uncertainty effect on the faults identification. In addition, the SMO exploits only the input/output measurements which are available in the system without additional hardware complexity. The proposed method is able to identify and isolate the current sensor faults accurately under wind conditions. Finally, the proposed method was successfully tested in real-time using a lab bench with dSPACE 1104. The obtained experimental results show clearly the accuracy and the effectiveness of the proposed method.

Keywords : Sensor fault diagnosis, Sliding mode observer, PMSG, Wind energy

Code : E03

Evaluation of the impact of climatic conditions on amorphous Silicon PV module performance in the desert environment

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Abstract

This study is investigate the impact of climatic conditions on the performance of photovoltaic modules installed in the desert region in south of Algeria. The performance of QS-60DGF module under daily weather conditions is evaluated. and the effects of partial shading and accumulation of sand dust for a period of one years on power loss and the current–voltage characteristics of photovoltaic modules are examined. and show the visual inspection of the degradation of the QS-60DGF modules such as glass breakag and the influence of high temperature and the other climatic factors in the Saharan environment observed in the field at the Unit of Research in Renewable energy URERMS Adrar.
The experimental results show that the performance parameters such as maximum output current (Imax), maximum output voltage (Vmax), maximum power output (Pmax), open-circuit voltage (Voc), short-circuit current (Isc) and fill factor (FF) of QS-60DGF modules are degraded after these year of exposition.

Keywords : Thin-film PV module, Performance parameters, Degradation evaluation, Saharian environment.

Code : E04

Delamination defects localization in carbon fiber composite laminates using ultrasonic signal processing

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Abstract

Wind turbine blades are one of the most critical parts of a wind turbine system. They have a significant impact on the entire wind power system. Composite materials with polymeric matrices presents the material used to fabricate wind turbine blades. Despite all the characteristics of this type of material, it can deteriorate under certain conditions. That is why wind turbine blades should be inspected periodically. Ultrasonic techniques are well known techniques that have been used in composites material part inspection. In data collected by ultrasound technique from a composite material part is not constantly simple to detect and locate existing defects. Modern signal processing algorithms used to improve the ultrasound data resolution. Methods based on time–frequency analysis are mostly used. The measure of the improvement resulting from the signal processing methodology can be confirmed for instance by evaluating A-scans containing defects near the surfaces of inspected specimens. In this work, we describe a proposed algorithm for processing A-scans ultrasonic data, in order to increase existing defects resolution and localization. The proposed method is based on modified Stockwell transform, global time-frequency thresholding and normalized Shannon energy envelope. The algorithm is evaluated using simulation phantom as well as on a real specimen both including delamination defects close to front surface. The proposed method can precisely locate the defect delamination.

Keywords : Composite, Wind turbine blades, Ultrasonic signal, Modified stockwell transform, Global thresholding, Shannon envelope.

Code : E05

A principal component analysis of complex Iridium hydrides $XYIrH_6$ (X=K, Na: Y= Ba, Sr, Ca) and osmium hydrides $ZOsH_6$ (Z=Ba, Sr, Ca, Mg)

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Abstract

Different theoretical methods were used to classified, select and study the hydrides. In this paper an attempt has been made to classified and studies the complex transition metal hydrides $XYIrH_6$ (X=K, Na: Y=Ba, Sr, Ca) and Osmium hydrides $ZOsH_6$ (Z=Ba, Sr, Ca, Mg) by mean of a datamining approach. The datamining approach used here is a principal component analysis (PCA) to identifying the minimum number of descriptors necessary to capture all the information of a system. A database was performed of several complex transition metal hydrides collected from literatures. The results show that bulk modulus, shear modulus, gap energy of complex transition metal is significantly influenced by the lattice parameters. The effects of the processing parameters were investigated and evaluated. The obtained results from PCA are in reasonable agreement with those observed from experimental data and theoretical classification methods.

Keywords : Principal component analysis (PCA), Complex transition metal hydrides.

Code : E06

Solid oxide fuel cell power management based on a predictive controller

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Abstract

At present, renewable energies play a preponderant role, because we are experiencing the depletion of fossil energy, especially, fuel cells. The basic principle of these batteries is based on chemical reactions, which explains their slow response, the progress of the control, which requires investing in this field so that the systems based on batteries reach maturity. In this paper, a new technique is presented for the control of the active and reactive powers coming from an energy production system based on an SOFC fuel cell. First, the system considered is presented containing an SOFC fuel cell, a PWM inverter and an AC load, the validity of these analyzes is verified when the energy production system is subjected to load variations with the use of a conventional PI and GPC controllers for a given load. Also when the load variation becomes faster, the results show that with the GPC control, the requested powers are almost identical to that supplied. By this work, it can both test the validity of this control, as well as the robustness.

Keywords : SOFC fuel cell, PWM Inverter, Power management, GPC controller.

Code : E07

Direct power control (DPC) of PMSG integrated in a wind system

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Abstract

The study of a wind energy conversion system (WECS) based on a permanent magnet synchronous generator interconnected to the power grid is described. The efficiency of WECS can be greatly improved by using appropriate control. This paper presents the application of the integrated DPC technique in a WECS based on PMSG, this command based on directly controlling the active and reactive power in a PWM rectifier. The errors between the reference values of the instantaneous active and reactive powers and their measurements are introduced into two hysteresis comparators, which determine the switching state of the semiconductors, with the aid of a switching table.
With the help of MATLAB / SIMULINK, the results of the simulation show that this method of control has a good dynamic response of active and reactive power.

Keywords : Wind turbine, PMSG, PWM AC/DC converter, DPC.

Code : E08

Role of electrode material in Enhancing the performance of NiO/ZnO photodiode

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Abstract

In recent years NiO/ZnO heterojunction photodetectors have emerged as a suitable option for detecting UV wavelengths. Focusing on the influence of the design process on the performance of the device, this paper represents the design and simulation study of NiO /ZnO photodiode with different types of electrodes. ATLAS module of SILVACO software was used. The characteristics such as Dark current, photocurrent, and responsivity reading current and wavelength of photodetection for different designs by changing the conductive materials Palladium,Gold, Silver, and ITO. Comparing with four types of electrodes, the largest responsivity and the smallest dark currentwere obtained by using Agas an electrode.

Keywords : Design, NiO/ZnO heterojunction, Photodiode, Electrodes, Responsivity, DarkCurrent, Photocurrent.

Code : E09

Structural, elastic and electronic properties of transition metal hydrides TiH_2 and ZrH_2 from first principles calculations

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Abstract

The current work is an investigation on the structural, elastic and electronic properties of TiH_2 and ZrH_2 in the cubic phase by means of first principles calculations conducted within density functional theory using full potential linearized augmented plane waves (FP-LAPW) method. Besides, the mechanical stability of our materials along with the hydrogen storage capacity and hydrogen desorption temperature have all been addressed. Generally, good agreement between our findings and those available in the literature is observed.

Keywords : TiH_2, ZrH_2, Structural properties, Elastic properties, Electronic Properties, Hydrogen storage.

Code : E010

SM-MPPT Controller of DFIG based on variable speed wind energy conversion system

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Abstract

This paper deals with the modeling and control of the wind turbine based on doublyfed induction generator (dfig) via maximum power point tracking (MPPT) strategy to extract the maximum mechanical energy from the wind. In thi swork, the method of MPPT is elaborated and compared without wind speed measurement and with the speed of wind measurement by using tow deferents controllers PI and sliding mode. Simulations are carried out the comparison between MPPT sliding mode controller and MPPT PI controller and without wind speed measurement method, results simulation are shown that the control performance of MPPT sliding mode issuperior.

Keywords : Doublyfed induction generator (dfig), Maximum power point tracking (MPPT), MPPT sliding mode, MPPT PI controller.

Code : E11

Unit commitment of thermal units in integration with wind power generator

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Abstract

The inherent flexibility of the power system is becoming weak with the proliferation of wind generators into the traditional power system. The integration of large-scale wind power in a power grid brings tremendous challenges to the power system operation because of the intermittent and uncertain wind power adds to the problem of balancing load and generation. According to the influence of wind power integration on the security and stability of power system, deterministic unit commitment is currently used to economic dispatch, which takes reserve capacities to cope with the wind power fluctuation. This work considered the integration of thermal units with the renewable sources like wind at 30 bus IEEE, while accounting for ancillary service management and renewable energy uncertainties. The obtained deterministic problem is modeled using Mixed Integer Programming (MIP) on MATPOWER interface whereas the MOST solver is employed for its solution.

Keywords : Power system, Wind energy, Integer programming, Matpower interface, Unit commitment.

Code : E12

Techno-economic study of solar electrolytic hydrogen production at high temperature

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Abstract

Interest in green hydrogen, particularly in hydrogen produced using clean renewable energy, is growing.
The present work deals with hydrogen production using temperature electrolyzer powered by a concentrating photovoltaic unit. A techno-economic study of the production system is carried out. The effects of technological advances and of electrolysis temperature on the economics of hydrogen production are investigated.
Results indicate that an increase in PV efficiency and an increase in electrolysis temperature drastically reduce the cost of hydrogen production.

Keywords : Hydrogen production, Solar energy, CPV, High temperature electrolysis, Economic competineness.

Code : E13

Effect of thickness and pretreatment on the physicochemical quality of sun-dried camelina meat

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Abstract

This work is an experimental study of the effect of thickness and pretreatment on the physicochemical quality of sun-dried camelina meat under the meteorological conditions of Ouargla city in the south-east of Algeria. During the study of the most influential pretreatments parameters, two operating parameters are chosen: thickness (0.4 ± 0.03 cm and 0.8 ± 0.03 cm) and dwell time in a saline solution of sodium chloride (30 minutes and 90 minutes), and then a complete factorial experimental design with two factors and two different levels is adopted.

The results show that 30 minutes of residence time in the saline solution and 0.582 cm of thickness of the meat slices are the optimal conditions for the pretreatment. Under these optimal conditions, the retention rate of proteins is 94.02%, of lipids 26.95%, the color 76.32%, the shrinkage 50.99% and the maximum moisture rate is 91.11% with a final salinity of 2.64%.

Keywords : Optimization, Pre-treatment, Camelina meat, Sun-drying, Physico-chemical quality.

Code : E14

Improvement in wind energy sector using nanotechnology

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Abstract

Harnessing wind energy is of important use for energy security, economic growth, sustainable development and security of environment. But it is also true that wind energy suffers from various challenges related to its sustainability as important energy source. Some of the important barriers are manufacturing cost, environmental factors, site specific, Low energy production etc. Conventional wind turbines were designed to be large in size so that they have power to turn turbine to produce sufficient power which in turn create difficulties in transportation and installation of wind turbine. Therefore there is need to develop such technology which can overcome above difficulties by using lightweight materials and low cost materials. Thus nanoscale models developed prolong the overall life of wind turbines by mitigating the fatigue failures of structural components and reducing the overall cost of power generation. Nanoscale technology introduced into wind industry contributes in bringing new development for wind turbines performance, operability, availability and reliability.

Keywords : Nanotechnology, Wind energy, Carbon nanotubes, Nanolubricants.

Code : E15

Operation assessment of the Kabertane's photovoltaic power plant

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Abstract

In order to effectively operate renewable energy power system in an isolated area like Adrar, a methodology is presented in this work with an aim on how to assess the operation of a solar photovoltaic (PV) plant implemented under the first phase of Algeria's national renewable energy program. A statistical approach study of the PV plant installed in Kabertane site is investigated. For performance assessment, different meteorological variables of two cloudy and two clear days were considered. In order to illustrate the impact of the wind speed in PV operation on Kabertane site, one week horizon study was investigated. Our study shows how the measured of different meteorological variables should be preferred for the future development and operation of solar PV power projects. Furthermore, the presented statistical study is presumed as an approach to evaluate the performance of any solar PV plant.

Keywords : Solar photovoltaic, Air temperature, Humidity, Wind speed, Power output, Solar irradiation.

Code : E16

Hydrogen production by dark fermentation

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Abstract

Dark fermentation, photo-fermentation, hybrid system, direct bio photolysis, and indirect bio photolysis are all types of biological processes used to produce bio hydrogen. Dark fermentation involves bio hydrogen production by anaerobic bacteria from carbohydrate-rich substrates in the absence of light, whereas in photo-fermentation, photosynthetic bacteria use light energy to produce bio hydrogen from various organic acids, food processing and agricultural wastes Dark fermentation and photo-fermentation are complementary technologies and can be used sequentially in a hybrid system. In direct bio photolysis solar energy is used by algae and cyanobacteria to convert water into oxygen and bio hydrogen. On the other hand, indirect bio photolysis involve separation of the bio hydrogen and oxygen evolution reactions into separate stages, coupled via carbon dioxide (CO_2) fixation/evolution.
Dark fermentation present advantages when compared to other biological processes because it is light-independent and different raw materials can be used as a carbon source to the microorganisms, which have both a high rate of bio hydrogen production and growth rate to supply the system. Furthermore, strict and facultative anaerobic microorganisms can be used in the form of pure cultures and mixed cultures. Unlike mixed cultures, pure cultures require a sterile environment to prevent contamination, which is difficult and expensive to achieve in industrial scale. For this reason, mixed cultures have been preferred in scaled-up applications.

Keywords : Hydrogen production, Biological process, Dark fermentation.

Code : E17

DTC of DFIG included in a wind turbine connected to the grid

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Abstract

This article presents a contribution of the application of direct torque control, for the control of the powers of a double power induction generator (DFIG), used in a constant speed wind energy conversion system. This type of control based on two hysteresis band controllers of torque and flux.

The simulation results showed that it is possible to control the stator powers with this method.

Keywords : DFIG, DTC, Wind turbine, Grid.

Code : E18

Numerical simulation of multi-quantum well solar cells (MQWSC)

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Abstract

In this work; we presente the result of numerical simulation study of multiple quantum well MQW GaAs/InAs solar cell where cell is formed by a number of InAs quantum well separated by GaAs as barrier. The calculation of threshold wavelength necessitates numerical resolution of Schrödinger equation in order to obtain the effective forbidden band-gap for every Multi-Quantum Well Solar Cells. In this simulation we are using a simulator SILVACO-TCAD. We will present the impact of thickness and number of well and barrier on solar cell parameters. Our simulation shows that increasing number of wells in the intrinsic region of InAs - GaAs structure increases efficiency for narrow wells where the thickness is under 8 nm while it decreases for wider wells (> 9nm). An optimised cell is obtained where an efficiency exceeding 27% can be obtained; this value is clearly greater than the zero quantum well structure 22%.

Keywords : Quantum well, Schrodinger equation, Silvaco, Pin solar cell.

Code : E19

Structural, electronic, and thermodynamic properties of a rare earth dihydride TbH_2

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Abstract

We have performed ab initio calculations of electronic structure, equilibrium and thermodynamic properties for the rare earth dihydride TbH_2 using the full-potential linearized augmented plane wave method (FP-LAPW) approach within the density functional theory (DFT) in the generalized gradient approximation (GGA) and local density approximation (LDA) as implemented in the WIEN2k simulation code at 0K. The equilibrium properties have been determined, the density of states, electronic density, the energy band structures and thermodynamic properties are studied in details. It was concluded that the GGA optimized lattice parameter agrees much better with the experimental findings than the LDA one. Two low-lying hydrogen-metal bands of TbH_2 were observed. The Fermi energy EF falls at a level where most of the states are rare-earth 5d conduction states. We obtain information on the negligible role of the H 1s state contribution near EF.

Keywords : Rare-earth dihydrides, TbH_2, Density functional theory, ab initio calculations, WIEN2k.