

International Conference on Sustainable Energy, Mechanics, Advanced Materials, Hydrogen Innovation and Environment Sciences



Topic 1

Mechanics

Topic 2

Advanced Materials

Topic 3

Energy & Environmental Engineering

Topic 4

Hydrogen Innovation and Environment Sciences

 L'Ecole Nationale des Sciences Appliquées d'El Jadida



<https://ecopower2024.sciencesconf.org/>

May 28, 2024			
08:00 - 08:30	Regstration		
08:30 - 09:00			
09:00 - 09:30	Ouverture		
09:30 - 10:30	<p>Plenary 1 Pr. Fouad Erchiqui Mechanical Engineering (University of Quebec in Abitibi-Témiscamingue, Rouyn-Noranda (QC, Canada))</p> <p>Plenary 2 Prof. Mohamed BALLI Physics of materials (Associate Professor of Physics at the International University of Rabat and at Sherbrooke University, Canada)</p> <p>Plenary 3 Prof. Mourad Nachtane " AI and composite materials for Hydrogen storage tank design" (Assistant Professor at UM6P)</p>		
	Coffee break		
10:30 - 10:50	Keynote 1	Keynote 2	Keynote 3
10:50 - 11:05	<p>Adsorption CV dye from aqueous solution by graphene oxide grafted cellulose(GO@Cellulose) adsorbent Zarrik Basma</p>	<p>Application of Non-Linear Techniques in Passive Hybrid Circuits for Piezoelectric and Pyroelectric Energy Harvesting El Hmamsy Youssef</p>	<p>Assessment of Corrosion Inhibition Efficiency on Low Carbon Steel in Phosphoric Acid Medium Using a Green Inhibitor Extracted from Agricultural Waste Sources Moughazi Yassine</p>
11:05- 11:20	<p>A novel Chitosan-Alginate@Fe/Mn Mixed Oxide Nanocomposite for Highly Efficient Removal of Cr (VI) From wastewater: Preparation, Characterization and Removal mechanisms El Kaim Billah Rachid</p>	<p>Application of PLS-ANN Hybrid Advanced Chemometric Models for Turbidity Mitigation in COD Quantification in Water Nini Meryem</p>	<p>Comparative study and Damage Modeling by Fracture of Acrylonitrile Butadiene Styrene (ABS) Bouhsiss Hassan</p>
11:20 - 11:35	<p>Ab-initio investigation of structural, electronic, and optical properties of the Rb₂CuSbCl₆ double perovskite. Bouzidi Mustapha</p>	<p>Competitive Adsorption of Two Phenolic pollutants Compounds Using a Novel biosorbent : Analytics (HPLC), Statistical (experimental design) , and Theoretical Study (DFT) Boufid Taoufiq</p>	<p>Evaluating the Effects of Temperature and Root Activity on Soil Water Distribution Using HYDRUS-(2D/3D). Jaefar Abderrahim</p>
11:35 - 11:50	<p>A comparative study of the structural, electronic, and optical properties of Ge-based perovskites AGeCl₃ : Insights from DFT simulation El-Moudenib Khadija</p>	<p>Validated TRNSYS model for an Indirect Solar WaterHeater with Forced Circulation in various weather Zouitine Asmaa</p>	<p>Fiabilité et Endommagement en Mode II d'un Composite en Fatigue Segnidi Hamza</p>
11:50 - 12:05	<p>Allaoui Mohamed Adsorption of a trivalent metallic micropollutant using a calcarbonate salt based on CaCO₃</p>	<p>Theoretical and FEA Modeling for Thermal Energy Harvesting using Pyroelectric Materials. Chouaib Ennawaoui</p>	<p>Finite element modeling of the human ear using a lumped parametric model of the middle and inner ear Elghanaoui Souad</p>

12:05 - 12:20	An Exploratory Assessment Supported by Experimental and Modeling Approaches for Dinitrophenylhydrazine Compound as a Potent Corrosion Inhibitor for Carbon steel in Sulfuric Acid solution Ait El Caid Zakaria	Thermal investigation of the effect of double glazing on the energy efficiency of a photovoltaic (PV) module Ahliouati Mohamed	Integration of a G-Code instruction to Abaqus Script Converter for improvement of the 3D Printing Process Simulation Hachimi Taoufik
12:20 - 12:35	Clay based materials for clean energy El Ghouali Noura	The impact of varying the thickness of buffer and absorber layers on CuBi2O4 can be examined using SCAPS simulation and impedance spectroscopy. Farajy Mohammed	Interaction entre l'Angle de Rotation et le Rapport de Portance : Impact sur le Comportement Structural d'une Poutre en Beton Armé Kajja Mustapha
12:35 - 14:30	Lunch		
14:30 - 15:00	Plenary 4 Prof. Dr. İlhami ÇOLAK "Impacts of Digital Transformation on Alternative and Green Energies" (Assistant professor of Electrical Engineering at Gazi University, Turkey) Plenary 5 Prof. Hassan NAANANI "IA for renewable energy" (Assistant Professor at UM6P)		
15:00 - 15:20	Keynote 4	Keynote 5	Keynote 6
15:20 - 15:35	Complex conductivity as a tool to investigate the impact of H2S Concentrations on conduction mechanisms in Composite Sensor (n-ZnO/rGO). Hilmi Dalal	Degradation of an emergent antibiotic using Sono-Fenton process in aqueous media. Sandaoui Meriem	Mechanical characterization of (CPVC) using tensile tests at various temperatures and crosshead speeds Khtibari Abderrahim
15:35 - 15:50	Development of new catalytic materials for liquid effluent disposal Lagrini Hakima	Enhancing Hydrogen Desorption Kinetics in Mg2NiH4 through Iron Doping Belkoufa Ikram	Optimization Methods for Predicting the Optimal Insertion Position of Earplugs in the Ear Canal: A Study on a 2D Axisymmetric Model of the Human Ear Rich Mohamed
15:50 - 16:05	DFT Investigation of Optical Properties of the Wurtzite Phase of zinc oxide Ait Lamine Lahcen	Examining the Mechanisms and Selectivities of Both the non-Catalyzed and Lewis acid-Catalyzed Diels-Alder Reaction Involving R-Carvone and Isoprene: MEDT Study Elidrissi Khadija	Predicting Concrete Fatigue Life under Cyclic Compression: A Random Forest Approach Moussaddaq Chouaib

16:05 - 16:20	DFT Investigation of Structural, Electronic, and Optical Properties of Rutile SnO ₂ Using the Functionals BLYP, PBE, PZ, PBESOL, and VWN-RPA Ait Lhaj Abderrahim	First-principles study of AeCrH ₃ (Ae=Be, Li) perovskite type hydrides for optoelectronics and hydrogen storage applications Azdad A.	Predictive Maintenance in Industry 4.0: Advancements and Challenges Zaroual Soumaya
16:20 - 16:35	DFT study on the electronic, structure, magnetic and optical properties of TiO ₂ anatase Sadek Otmane	Flexible screen-printed electrochemical sensor based on Cu, Poly 1,5-Diaminonaphthalene and Carbon Black for nitrate detection in water Benhaiba Saad	The Effect Of A Half-Vehicle Suspension System For The Evaluation Of Power Harvesting Using A Numerical Simulation Method Maziane Youssef
16:33 - 17:00			
17:00 - 17:15	Effect of friction stir welding parameters on microstructure and mechanical properties of the dissimilar alloys of AZ91D and AA7075 Nait Salah Abdellah	Hydrogen supply chain: an overview Abousalim Zineb	The intrinsic decoherence dynamics of quantum teleportation and dense coding in a system with two coupled double quantum dots Sabor Aboubakre
17:15 - 17:30	Effect of Ti-doping on Magnetic, Mechanical, Band Structure, Thermoelectric, Optical and Thermodynamic Properties of Co ₂ FeSn Full Heusler Moulay Youssef Raia	Novel Complex Conductivity Approach for Monitoring a Domestic Wastewater Treatment System with Sand and Hearth Ash Filtration El Hafidi El Mokhtar	Theoretical Analysis of Cycloaddition Reaction of Isatine's Azomethine Imines: Exploring Their Role as Dipolarophiles Moutakif Fatima
17:30 - 17:45	Examining the Mechanisms and Selectivities of Both the non-Catalyzed and Lewis acid-Catalyzed Diels-Alder Reaction Involving R-Carvone and Isoprene: MEDT Study Elidrissi Khadija	Desalination Reverse Osmosis reject brine as a novel-based porous geopolymer for phosphorus removal from contaminated media Fatima Zahra Karmi	Vector control of an asynchronous motor through flux orientation Kamel Hamza
17:45 - 18:00	Experimental and simulation study of microstructure and magnetic properties of (AlFeMnNi) _{1-x} Nd _x Abjaou Ali	A Comprehensive Comparison of Active and Passive Circuits for Mechanical Energy Harvesting Using Piezoelectric Materials Bensaid Loubna	Numerical simulation with LBM of natural convection in a cubic cavity Karim Choukrallah
17:45 - 18:00	Exploratory study of potential usefulness of cost effective composites thin films for energy device Hammi Maryama	A- β -D- β -A Small Molecules Photovoltaic Based on Thiophene with an end-group effect: TD-DFT Study Zouitina Said	Active Matter: Elaboration, characterization and applications in wastewater treatment Fatima-Ez-Zahra Grini
18:00 - 19:00	Poster Session I		

May 29, 2024			
08:30 - 9:00	Plenary 6 Prof. Mustapha El Alami "Phase change materials and thermal storage" (Professor of Thermal Science at Hassan 2 University in Casablanca, Morocco) Plenary 7 Prof. El Kebir Hlil "Physics of materials" Professor of Physics of Materials in Grenoble Alpes University, France		
9:00 - 9:20	Keynote 7	Keynote 8	Keynote 9
09:20 - 09:35	Exploring the potential application of raw bentonitic clay resources sourced from Nador-Morocco, in the ceramic fields. Imgirne Ayoub	Application des ondes ultrasonores de basse fréquence en milieu aqueux pour l'élimination d'un colorant azoïque Aboufadile Mohamed Amine	Development of new catalytic materials for liquid effluent disposal Lagrini Hakima Synthesis and Stability Investigation of TiO ₂ Nanofluids for PVT Applications Khadija chakar
09:35 - 09:50	Flexible screen-printed electrochemical sensor based on Cu, Poly 1,5-Diaminonaphthalene and Carbon Black for nitrate detection in water Benhaiba Saad	Characterization of the bio-char and its application on the removal of the organic load of polyphenols from the OMW Elamraoui Sabah	Evaluating the Potential of Floating Solar Photovoltaics for Water Conservation: Case Studies on Four Hydroelectric Dams in Morocco Mouhaya Abdelilah
09:50 - 10:05	Highly Anisotropic Optical, Electronic and Magnetic properties of the Kitaev Spin Liquid candidate Ir-RuCl_3 Bouhmouche Ayoub	Designing an Integrated Energy System for Self-Sustaining Housing El Mrini Youssef	Experimental and theoretical study of epoxidation reactions of halogen derivatives of himachalen with metachloroperoxybenzoic acid (m-CPBA) Ilham Ait Braim
10:00 - 10:30	Coffee break		
10:30 - 10:45	Influence of Lithium Doping on the Structural and Dielectric Characteristics of $\text{BaTi}_{1-x}\text{Li}_x\text{O}_3$ Ceramics Prepared via Sol-Gel Process El Aychaoui Fouad	Enhancing InGaN/GaN quantum-well solar cells in Ga Polarity with Piezo-Phototronic Effects: Revealing the Influence of External Stress Hamza Bousdra	Klein tunneling in heterostructures based on tilted Dirac materials Ragui Mohamed
10:45 - 11:00	Insights on the corrosion inhibition control of C38 steel in acidic environment employing a natural inhibitor derived from Oil press cake waste process Kellal Rachid	Implementation of an environmental management system in a gallery construction site Casablanca Morocco Bakkass Soukaina	Magnetic properties and hysteresis behaviors of a cylindrical ferrimagnetic Ising nanowire system with a core/shell structure El Abbassi Ahmed

11:00 - 11:15	Intrinsic decoherence of quantum correlation and dense coding in a dipolar interaction system of spin-1/2 particles with the Dzyaloshinskii-Moriya interaction Adnane Brahim	Innovation of practical and adjustable strategies for the implementation of sustainable reverse logistics process in industrial and commercial sectors Dnaya Soukaina	Mean Field Approximation and Monte Carlo Simulation of the mixed spin (1/2, 2) hexagonal nanotube with core-Shell structure El Kihel Karima
11:15 - 11:30	Investigation of the Structural and Optical Characteristics of La ₂ FeCrO ₆ double perovskite for optoelectronic applications Lemziouka Abdelmoula	Exploring Hybrid Energy Systems with Low Carbon Footprint: A Comparative Study of Moroccan Coastal Cities in the Atlantic Region Aissi Tarik	Mechanistic Insights into the Selective Synthesis of 4H-Pyran Derivatives On-Water Using Naturally Occurring Alginate from Sargassum muticum Oudghiri Khaoula
11:30 - 11:45	Numerical simulation with LBM of natural convection in a cubic cavity KARIM CHOUKRALLAH	Mitigating Temperature-Induced State of Charge Drift in Battery Estimation Using Machine Learning Elachhab Anass	Structural investigation of Li ₂ O-ZnO-P ₂ O ₅ -B ₂ O ₃ quaternary glass system by Raman, FTIR and thermal analysis Bougrine Khadija
11:45 - 12:00	Nitrate intercalated Mg ²⁺ -Al ³⁺ -Fe ³⁺ Layered Double Hydroxides based solid solutions series : Preparation, characterization, thermal stability and optical properties Lahkale Redouane	Optimizing autonomous nanogrid operations for community-based energy sharing Souda Abdelhadi Synthesis and Stability Investigation of TiO ₂ Nanofluids for PVT Applications Khadija Chakar	Synthesis and characterization of new TiO ₂ nanomaterials with hierarchical porosity by the sol-gel route, using sodium alginate as surfactant, and of Ag/TiO ₂ by the wet impregnation method Hakima Lagrini
12:00 - 12:15	Novel Complex Conductivity Approach for Monitoring a Domestic Wastewater Treatment System with Sand and Hearth Ash Filtration El Hafidi El Mokhtar	Investigation of photovoltaic performance of lead-free InSnCl ₃ -based perovskite solar cell: First Principle Calculations and SCAPS-1D Analysis Garmim Taoufik	Optimizing Sugar Juice Extraction from Ceratonia siliqua L. Pulp: A One-Way ANOVA Study Outalb Khadija Advancing Predictive Maintenance in Renewable Energy Systems using Statistical Control Charts Erroumayssae Sabani
12:15 - 12:30	Optical, dielectric, and mechanical properties of polymer-based nanocomposite films reinforced with clay. Rhalmi Othmane	Solid State Spectroscopy Fundamental Functions in a Nutshell Dnaya Fatima Ezzahra	Spin-waves excitation of amorphous ferrimagnetic Fe ₆₅ Gd ₁₅ B ₁₂ Si ₈ alloy El Ouahbi B
	Lunch		

15:00 - 15:20	Keynote 10	Keynote 11	Keynote 12
15:00 - 15:20	<p>Performance analysis and optimization of CdTe-based solar cell heterostructure. Elmourabit Fahd</p> <p>Effet de la décohérence intrinsèque sur la dynamique des corrélations quantiques et le codage dense dans un système de spin dipolaire Youssef Khedif</p>	<p>Surface effects on magnetic properties of a ferrimagnetic mixed spin system Saadi Hasnae</p> <p>Synthesis and Evaluation of Biological Activity of Benzodiazepines and Benzimidazolones Derivatives Youssef Fatima</p>	<p>Predicting the performance of LaFeCoSi compound in a magnetic cooling Sabor Aboubakre</p> <p>Preparation of a Porous Clay Heterostructures and Study of Its Adsorption Capacity of Ammonium ion from Aqueous Solutions El Mahmoudi Soufiane</p>
15:20 - 15:35	<p>The effect of Magnetic field strength on the Binding Energy and Spatial Extension of an Off-Centre Donor Impurity in ZnS/CdSe Nanostructures Zouitine Asmaa</p>	<p>Synthesis and Characterization of Ceramic Piezoelectric Materials Misski Bouabid</p> <p>Solar Radiation forecasting Through Artificial Neural Networks Khouili Oussama</p>	<p>Proposed Product Data Model for Managing Vaccine Lifecycle Allam Sanae</p> <p>Synthesis and Characterization of Cu₂ZnSnSe₄ Absorbent Thin Films via Single-Step Electrodeposition for Photovoltaic Applications Rkia El Otmani</p>
15:35 - 15:50	<p>Caractérisation structurelle et optique de la pérovskite CaTiCrO Ruddlesden-Popper : aperçu d'une application avancée de cellules optoélectroniques et solaires Mounir Lakdadi</p> <p>Etude expérimentale de l'effet des conditions aérothermiques sur les courbes de séchage du Néflier du Néflier El Houssayne BOUGAYR</p>	<p>The anti-corrosive potential of a newly developed organic phosphonic acid on carbon steel in sulfuric acid Jafil Hayat</p> <p>COMBINAISON D'AMPLIFICATEUR À FIBRE À SEPT CŒURS CO-DOPE SDM-WDM Er³⁺/Yb³⁺ Ali Nassiri</p>	<p>Risk management using artificial intelligence for sustainable mining Biadi Wafaa</p>
16:30 - 17:00	Coffee break		
17:00 - 17:15	<p>The Effect of Surface and Bulk Exchange Interaction on the Magnetic Properties and Phase Transition of Mixed-Spin Ising System: A Monte Carlo Study Khairi Meryem</p>	<p>Study of the photocatalytic degradation of methylene blue by TiO₂ multilayer Sadek Otmane</p>	<p>The impact of varying the thickness of buffer and absorber layers on CuBi₂O₄ can be examined using SCAPS simulation and impedance spectroscopy. Farajy Mohammed</p>
17:15 - 17:30	<p>The control of dissolution of carbon steel in acid electrolyte by a molecular coupling of the quinolinol-5-azobenzimidazole model Fakhry Hicham</p>	<p>The Effect Of A Half-Vehicle Suspension System For The Evaluation Of Power Harvesting Using A Numerical Simulation Method Maziane Youssef</p>	<p>Theoretical Study of Structural and Electronic Properties of Barium Stannate using DFT-LDA Approach Ouazik Brahim</p>

17:30 - 17:45	The magnetization behavior at low temperatures in amorphous Eu ₈₀ Au ₂₀ alloy El Ouahbi S.	Study of the Influence of Yttrium Ions on the Structural, Physical, and Optical Properties of Strontium Phosphate Glasses for Photovoltaic Solar Cell Applications Bouabdalli El Mahdi	Immobilization of Cobalt oxide onto mesoporous activated carbon for peroxymonosulfate activation El Mehdi Chatir
Poster Session II			
19:00 - 19:30	Discussions and closing remarks		

Tuesday, 28 May

Excursion & Free time (9H)

Poster Session I

1	Collimation of Dirac fermions in an inclined Dirac cone material through double barriers Raggi Mohamed
2	Comparative Study on Magnetic Stability, Electronic, Optical, Thermoelectric and Thermal properties of Co ₂ FeSn and Fe ₂ CoSn Full Heusler alloys from first principles study My Youssef Raia
3	Critical properties of the spin-3/2 Blume-Capel model with a random transverse crystal field El Kihel Karima
4	Crystal structure, spectroscopic and optical study of Iron Orthophosphate. Fakhreddine Rachid
5	Development of Metal Phosphates Nanoarchitecture Electrocatalyst for Hydrogen Evolution Reaction for Green Hydrogen Production Barhoumi Soufiane
6	Effects of Mn doping on the structural, linear and nonlinear optical properties of Gd ₂ O ₃ nanoparticles Hiti Awatif
7	Electrocatalysts Development for Oxygen Reduction Reaction in Phosphoric Acid Fuel Cell Technology Khaoula Sarout
8	Green synthesis of iron nanoparticles using Aloe vera plant extract, characterization and electrochemical application Bendehhou Atif
9	Investigated electrical and dielectric properties Zn-Al Layered Double Hydroxide through anionic exchange with ethylenediaminetetraacetate Ben Zarouala Khadija
10	Investigated the electrical and dielectric properties of carbonate intercalated Mg-Al Layered Double Hydroxides with different Mg/Al molar ratios Ben Zarouala Khadija
11	Investigation of the impact of erbium on the structural, physical, and optical properties of sol-gel synthesized silicophosphate glasses for photonics applications Bouabdalli El Mahdi
12	Light Scattering by Particles of a Polygonal-Based in The WKB Approximation Redouane Lamsoudi

13	Numerical simulation of a multilayer structure for hybrid energy harvesting Salhi Imane
14	Structural and Optical Analysis of Sm ₂ Sr _{0.5} Ba _{0.5} Fe ₂ O ₇ Synthesized by Sol-Gel Method: Potential for Optoelectronic and Nonlinear Optical Applications Fatima Nekkach
15	Structural, electronic, and magnetic properties of ZnTe doped with transition metal Mn Brach Ahmed
16	Study of Surface effects a ferrimagnetic system by Monte Carlo simulation Saadi Hasnae
17	Synthesis and Characterization of Ceramic Piezoelectric Materials Misski Bouabid
18	Synthesis and characterization of Co _{3-x} Mg _x (PO ₄) ₂ catalysts for photocatalytic and electrochemical applications (decomposition of organic pollutants from industrial effluents and production of hydrogen) Mouakkar Anas
19	Synthesis, Characterization and Biological Activity of Benzimidazole Derivatives Youssoufi Fatima
20	Synthesis, Characterization and Evaluation of the Anticancer Activity of a New Bispyrazolic Compound: 2-(5-Methyl-1H-Pyrazol-3-Yl)-N-[2-(5-Methyl-1H-Pyrazol-3-Yl) Acetylboranyl] Acetamide Abouelhaoul Elalami
21	Synthesis, Characterization and Evaluation of the Anticancer Activity of New Bispyridone Derivatives Abouelhaoul Elalami
22	Synthesis, Characterization, and Study of Dielectric, Electrical, Optical, and Mechanical Properties of Biocomposite Films Based on MCC Particle-Reinforced Polymer. Rhalmi Othmane
23	A sustainable approach for the formulation of an environmentally Carbonous based Biochar derived from a plant waste extraction process as a potential low-cost Adsorbent destined for wastewater treatment. Kellal Rachid

Wednesday, 29 May

Excursion & Free time (9H)

Poster Session II

24	Green hydrogen production by water splitting Makboul Wissal
25	Hydrogen storage Arharbi Amal
26	Novel Biosorbent for Competitive Adsorption of Two Phenolic Pollutants: Analytical (HPLC), Statistical (Experimental Design), and Theoretical (DFT) Investigations Bouزيد Taoufiq
27	Reaction of N-alkylation by Calcined Red Algae (CRA) doped with K ₂ CO ₃ (K ₂ CO ₃ @CRA) as solid catalyst Driss Ouzebila
28	An Amended Indirect Adjustable Step Size InC MPPT Control Strategy Using PID Controller for PV System Applications Chellakhi Abdelkhalek

29	Application and evaluation of solar energy in seawater desalination Boudraham Salima
30	Coupled heat transfers by conduction, convection and radiation in an inclined square cavity Baalla Ayoub
31	Developing A New Model For Battery Soc Prediction Considering Temperature Hysteresis. Tabine Abdelhakim
32	Environmental Impacts of Oulad Berjal Landfill: Contamination of Groundwater and Soil Pollution: Salhi Rhizlane
33	Innovative System for Harvesting Tidal Energy: Simulation and Experimental Results Sayaghi Chouaib
34	Modeling a Thermoelectric Cooling System of a Photovoltaic Panel using Thermoelectric effects Kandry Hafsa
35	Modeling a Two-Terminal Monolithic Perovskite/CISe Tandem Solar Cell: A Computational Approach Moujoud Salaheddine
36	Numerical investigation of Photovoltaic system integrated with Thermoelectric generator Amallal Fatima
37	Numerical study of the novel inorganic InSnCl ₃ based perovskite solar cell using SCAPS-1D device simulation Garmim Taoufik
38	Optimizing Photovoltaic/Thermal Efficiency: Integrating a Half-Circle Profile Tube for Enhanced Heat Dissipation Riad Ayoub
39	Temperature and current amplitude effects on the aging of lithium-ion batteries: implications for performance and lifespan Tabine Abdelhakim
40	The study of the regeneration of deactivated catalysts has been used in the production of sulfuric acid El Hasbaoui Nouredine
41	Valorization of Sludge through Solar Distillation: Design and Implementation Rezki Mohammed
42	WAVE ENERGY CONVERTER Abdellatif Abkhair
43	Doping and Structure-Promoted destabilization of NaBH ₄ complex Hydrid Ikram Belkoufa
44	Investigating the Reaction of (R)-Limonene with S-Thioacids Using Molecular Electron Density Theory Bendaoud Ahmed
45	Design and implementation of a novel adaptive MPPT algorithm for solar photovoltaic systems Hamid Belghiti