

Hani Muhsen

Associate Professor

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PROFESSIONAL PROFILE

Dr. Hani Muhsen is an accomplished Associate Professor in the Mechatronics and AI Department at the German Jordanian University, Amman, Jordan. He has over 18 years of experience in Electrical Engineering and Information Technology and a proven track record in research, teaching, and academic leadership.

Highlights:

- Expertise in electrical engineering systems, renewable energy, smart grids, and hydrogen technology.
- Published over 25 papers in international journals and conference proceedings.
- Secured DAAD scholarships for both M.Sc. and Ph.D. studies.
- Led research projects on digital twins, peer-to-peer trading, microgrid optimization, and hydrogen technology.
- Extensive experience in academic administration, including roles like Exchange Coordinator and Vice Dean.
- Supervised the establishment of a smart grid through an Erasmus+ project.

LINKS

Websites:

LinkedIn: <https://www.linkedin.com/in/dr-enghani-muhsen-9b011060/>

ResearchGate: https://www.researchgate.net/profile/H_Muhsen/publications

Google Scholar: <https://scholar.google.com/citations?user=ti6N2R4AAAAJ&hl=en&oi=a0%20>

Smart Grid Lab: <https://smartgrid.gju.edu.jo/>

EDUCATION

Palestine Polytechnic University

Sep 2000-June 2005

BACHELOR of ENGINEERING/Electrical Engineering/ Industrial Automation Engineering

- **GPA:** 87.6% (Excellent)
- **Major:** Electrical Engineering
- **Minor in Subject:** Industrial Automation Engineering
- Top Student (Rank 1) in B.Eng
- Excellence scholarship from the university

Jordan University of Science and Technology

Sep. 2006-Oct. 2009

MASTER OF SCIENCE/Electrical Engineering

- **Major:** Electrical Engineering
- Top 10% of Class
- **GPA:** 83.6 (Very Good)
- **Thesis:** TAGUCHI'S OPTIMIZATION METHOD AND ITS APPLICATION TO THE DESIGN OF ANTENNAS
- **Publications:** Dib, Nihad I., Sotirios K. Goudos, and Hani Muhsen. Application of Taguchi's optimization method and self-adaptive differential evolution to the synthesis of linear antenna arrays." Progress In Electromagnetics Research 102 (2010): 159-180.
- **Scholarships:** Full DAAD scholarship for M.Sc. Study.

Technical University of Chemnitz

Feb. 2013- Mar. 2016

DR.ENG./ Electrical Engineering and Information Technology

- **Major:** Electrical Engineering and Information Technology
- With Honors
- **Scholarships:** Full DAAD scholarship for PhD study
- **Publications:**
 1. H. Muhsen, J. Lutz and S. Hiller, "Design and Evaluation of Gate Drivers of SiC MOSFET," Proceedings of PCIM Europe 2015; International Exhibition and Conference for Power Electronics, Intelligent Motion, Renewable Energy and Energy Management, Nuremberg, Germany, 2015, pp. 1-8.
 2. S. Frankeser, H. Muhsen and J. Lutz, "Comparison of drivers for SiC-BJTs, Si-IGBTs and SiC-MOSFETs," Proceedings of PCIM Europe 2015; International Exhibition and Conference for Power Electronics, Intelligent Motion, Renewable Energy and Energy Management,

Nuremberg, Germany, 2015, pp. 1-9.

3. Hani Muhsen and S. Hiller, "A New Simplified Space Vector PWM Scheme for Two-Level Voltage Source Inverter," Proceedings of PCIM Europe 2015; International Exhibition and Conference for Power Electronics, Intelligent Motion, Renewable Energy and Energy Management, Nuremberg, Germany, 2015, pp. 1-7.
4. H. Muhsen, S. Hiller and J. Lutz, "Three-phase voltage source inverter using SiC MOSFETs — Design and Optimization," 2015 17th European Conference on Power Electronics and Applications (EPE'15 ECCE-Europe), Geneva, 2015, pp. 1-9, doi: 10.1109/EPE.2015.7309466.
5. H. Muhsen, S. Hiller, "A NEW STRATEGY FOR COMPENSATING THE DEAD-TIME IN CARRIER BASED PWM," 18th INTERNATIONAL SYMPOSIUM on POWER ELECTRONICS - Ee 2015 NOVI SAD, SERBIA, October 28th - 30th, 2015
 - **Dissertation:** Three-Phase Voltage Source Inverter with Very High Efficiency Based on SiC Devices

EXPERIENCE

Palestine Polytechnic University

Sep 2005 - Sep 2006

Teaching and Research Assistant

Teaching Electrical Engineering Courses and Labs for Diplom Students.

Wadi Alseer Technical College

Sep 2008 - July 2010

Lecturer

Teaching Electrical Engineering Courses and Labs for Diplom Students.

Tabuk University

Aug 2010 - Aug 2011

Lecturer

Teaching Electrical Engineering Courses and Labs for Bachelor Students

German Jordanian University

Oct 2016 - Present

Assistant Professor

Teaching Mechatronics Students, Electrical Machines, PLC, Modeling and Simulation, Instrumentation and Measurements, Supervising Graduation Projects. Research Conduction.

German Jordanian University

Feb 2017 - Oct 2017

Exchange Coordinator of Mechanical Engineering

Initialization and Finalization of Learning Agreement for exchange students. Supervising Exchange Students. Networking with German Partners.

German Jordanian University

Oct 2017 - Sep 2018

Dean's Assistant for Quality Assurance

Preparing SOPs for the School of Applied Technical Sciences. Supervising and Helping the filling of course Portfolios.

German Jordanian University

Sep 2018 - Sep 2020

Exchange Coordinator of Mechatronics Engineering

Initialization and Finalization of Learning Agreement for exchange students. Supervising Exchange Students. Networking with German Partners.

German Jordanian University

July 2021 - Present

Associate Professor

Teaching Mechatronics Students, Electrical Machines, PLC, Modeling and Simulation, Instrumentation and Measurements, Supervising Graduation Projects. Research Conduction.

German Jordanian University Vice Dean of Deanship of Students Affairs	Sep 2021 - Sep 2022
German Jordanian University Vice Dean of Scientific Research	Oct.2022-Oct.2023
German Jordanian University Dean of Students Affairs	July.2024-Sep.2025
German Jordanian University Library Director	Oct.2023-August.2025

LANGUAGES

Arabic (Native), English (Full professional proficiency), German (C1)

SKILLS

Electrical Engineering, Green Hydrogen Technology, Information Technology, Design Optimization, Renewable Energy, Smart Grid.

MEMBERSHIP

JEA Member (Jordan Engineers Association)	2007-Present
IEEE PELS (Power Electronics Society)	2017-Present
IEEE Member	2016-Present

CERTIFICATIONS, AWARDS, SCHOLARSHIP

The best Academic Award 2023 (2nd Position) GJU	2024
Trainer Certificate in Green Hydrogen and Power to X Training for Jordanian University Students GJU	Aug. 2023
Certified Consultant ISO 9001:2015 American Institute of Professional Studies	Mar 2018
Master Scholarship DAAD	Sep. 2006
PhD Scholarship DAAD	Apr 2011
Returning Expert Award GIZ	Oct 2017

German Jordanian University

Electrical Circuits and Machines, Electronics for Mechatronics, Hydrogen Technology, Electrical Machines, Electrical Machines Lab, Instrumentations and Measurements, Instrumentation and Measurements Lab, Special Topics in Electrical and Electronics Engineering, Programmable Logic Controllers, Programmable Logic Controllers Lab, Modeling and Simulation, Electronics, Actuators.

ATTENDED COURSES

Aveva Process Simulation Software Training	<i>August.2025</i>
Strategic Planning Optimal Training Center	<i>May 2024</i>
Capacity Building for Green Hydrogen Technology in Jordan KOIKA	<i>Sep.2023</i>
Online and Blended Learning GJU Consultation and Training Center	<i>Feb. 2023</i>
Train-of-Trainers Course on Renewable Power-to-X PTX-Hub, GIZ Introduction to Renewable PtX Production of Renewable PtX Renewable PtX Economics PtX Infrastructure Markets for Renewable PtX Sustainability Criteria for Renewable PtX Support Policies and Regulations for Renewable PtX	<i>Jan. 2023</i>
Certified Quality Management System Consultant American Institute of Professional Studies	<i>Nov 2017</i>
Sustainable Development Through Effective Knowledge Sharing Effective GIZ	<i>Feb 2018</i>
Arab Artificial Intelligence Summit 2019 Phi Science Institute	<i>Oct 2019</i>
Trojan Battery And Studer Off Grid Inverters And Chargers Technical Training Hydroturf Energy	<i>Jul 2019</i>
Smart Grid 1 University of Cyprus	<i>Feb 2019</i>
Smart Grid 2 Newcastle University	<i>Sep 2019</i>
Getting Started: Designing Online Learning Oxford University Press	<i>Sep 2020</i>
Taking It Further: Developing the Online Learning Experience Oxford University Press	<i>Oct 2020</i>

Feedback and Assessment	<i>Sep 2020</i>
Oxford University Press	
Supporting Your Students: Engagement, Inclusivity and Wellbeing	<i>Sep 2020</i>
Oxford University Press	
Energy Trading/Exchange in A Neighborhood/Digitization	<i>Sep 2020</i>
Middle East University	
OP-101: Fundamentals of Real-Time Simulation with RT-LAB	<i>Dec.2020</i>
OPAL-RT Technologies	
OP-203: Real-Time Simulation of Power Systems with ARTEMiS	<i>Dec. 2020</i>
OPAL-RT Technologies	
<hr/> COMMITTEES <hr/>	
Multimedia Committee	<i>May. 2024</i>
Scientific Research Committee	<i>Oct. 2023</i>
SATS School Council	<i>Oct. 2023</i>
Head of GJU Podcast Committee	<i>Dec.2023</i>
Kinder Uni Committee	<i>June.2022</i>
GJU	
Dual Study Committee	<i>Feb.2021- until now</i>
Preparing a dual study programs in the Mechatronics engineering Department	
University Council	<i>Oct. 2021-Sep-2022</i>
German Year Committee	<i>Sep 2018 - Sep 2020</i>
Discussing and proposing new rules and solutions for rising problems related to the German Year	
Disciplinary Committee at University Level	<i>Oct 2019 - Present</i>
Solving the problem dispute and investigating the truth and proposing punishments for the students.	
SATS Annual Report	<i>Oct 2016 - Oct 2017</i>
Create the first comprehensive school annual report •The report included unprecedented school academic and research statistics and analysis using 3 years data •The prepared report paved the road for subsequent annual reports in terms of format and content	
Quality Assurance Committee	<i>Feb 2017 - Oct 2017</i>
To establish SOPs for the mechatronics department	
School Council	<i>Oct 2019 - Present</i>
4th Year Committee for German Year	<i>Feb 2017 - Oct 2020</i>
To discuss the issues of the German Year for 4th year students	
Mechatronics Study Plan Committee	<i>Oct 2018 - Oct 2019</i>
To prepare the academic Plan for 2020	

ACTIVITIES AND INVITED TALKS

German Jordan University

Dec. 2019

Preparing and Conducting A Workshop on Smart Grid and Grid Integration of Renewable Energy Systems

Middle East University

Jan 2019

Preparing and Conducting A Workshop on Smart Grid Technology for Jordanian Stakeholders

Jordan University

Sep 2020

Trainer in Online Training Workshop for Students In The Frame Of The Erasmus Plus Program Egreen Project Number: 573927-EPP-1-2016-1-JOEPKKA2-CBHE-JP

Arab Union for Sustainable Development and Environment

Dec. 2020

Invited Talk for Innovations in Renewable Energy Resources: Smart Grid Technology

INTERNATIONAL ACTIVITIES

Reviewer for The 11th International Symposium on Hydrogen Energy, Renewable Energy and Materials (HEREM 2025)

2025

Reviewer for Springer Nature

2025

Reviewer for Advances in Science, Technology and Engineering Systems Journal (ASTESJ)

15.12.2020- Until Now

Reviewer for ICRIE2020 Conference

2020

Duhok, Kurdistan

Reviewer for INTELEC 2017 Conference

Queensland, Australia

Technical Committee of Special Session "Advancements for ISAECT 2020 Conference

Kenitra, Morocco

Publication Chair for IREC2021 Conference

Amman, Jordan

Special Training Session on Smart Grid Technology for The Syrian Universities

Feb. 2020

Amman, Jordan

GRANTS AND FUNDED PROJECTS

Multi-objective Evaluation of Green Hydrogen Production and Utilization to Support Hydrogen Economy in Jordan.

May. 2024

<https://www.gju.edu.jo/content/hydrogen-technology-and-smart-grid-lab-19907>

The Hydrogen Technology Cluster is a multidisciplinary research initiative that aims to uncover the potential of green hydrogen technologies in Jordan, considering numerous aspects. These include techno-economic feasibility, environmental sustainability, social equity, and equality relevant to adopting Green Hydrogen Production and Utilization (GHPU) schemes in Jordan. The project aims at

- Establishing a multidisciplinary green hydrogen research team and aiding in realizing the hydrogen technologies research hub at GJU.
- Examining the potential role of green hydrogen in a net-zero energy transition in Jordan concerning the energy-water nexus

in Jordan.

- Identifying the contribution that green hydrogen can make to Jordan's economic development on national and individual scales.
- Examining the social, environmental, and regulatory aspects relevant to adopting GHPU considering Jordan's context.
- Constructing a comprehensive green hydrogen roadmap considering Jordan's context.
- Implementing experimental investigations that evaluate the performance of GHPU systems under varying meteorological conditions.
- Disseminating knowledge and findings generated throughout the project to influence the development of the green hydrogen industry, regulatory frameworks, and socio-environmental considerations.

Green Hydrogen and Power-to-X for University Students Capacity-Building for Jordan's Future Workforce

12.2022-10.2023

<https://smartgrid.gju.edu.jo/Projects/6>

As a low-carbon alternative, Green Hydrogen has the potential to replace various high-carbon fuels that are now in use, reducing emissions in key industries. Jordan has a significant chance to build a Green Hydrogen economy by developing an (export-oriented) Green Hydrogen infrastructure since it has high Renewable Energy (RE) potential. Like this, Green Hydrogen can be used to help decarbonize the national economy. Furthermore, Green Hydrogen production in Jordan is considered to have significant commercial potential. Due to the low initial costs of RE, foreign companies might be attracted to invest in Green Hydrogen at competitive pricing. Nevertheless, one of the main challenges that authorities, investors, and stakeholders encounter is the deficiency of a skillful local workforce. To this end, this project aims to develop comprehensive material for university students to teach them about Green Hydrogen and Power-to-X technologies and implement training courses. The material will, for example, cover a thorough understanding of the whole value chain of Green Hydrogen from the production stage to the end use. Moreover, it will include related topics such as Hydrogen properties, Hydrogen derivatives, and the appropriate engineering design and sizing procedure for the design and operation of Hydrogen equipment. The Green Hydrogen for Jordan context will be included in terms of possibilities and challenges as well as the possibility of local use and possible potential export to Europe.

Advanced Teaching and Training on Smart Grid and Grid Integration of Renewable Energy Systems

Nov 2017 - Jul 2021

<http://www.meu.edu.jo/sites/atsgires/>

Erasmus+ Capacity Building Project

Budget: 999,000.00 Euros

Engineering-Based Economical Evaluation of The Retired Li Ion Batteries From Electric And Hybrid-Electric Vehicles

Aug 2018 - Dec 2020

DGSSR/ GJU

Budget: 49270 JD

Modeling and Simulation Distributed Energy Resources in Smart Grid: Management and Optimization

Feb.2021 - Feb.2023

DGSSR/ GJU

Budget: 25460 JD

Digital Twin Software to Control Part of Jordanian Electrical Networks with Considering the Cyber-security Aspect

April.2021 - April.2023

Royal Academy of Engineering

Transforming Systems through Partnership 20/21

Budget: 80,000.0 pound sterling

PUBLICATIONS

BOOK: Fundamentals of Green Hydrogen Supply Chain and Power-to-X

August.2025

Taylor and Francis

This book offers an engaging introduction to green hydrogen and its role in changing the global energy landscape. It explains theoretical and practical aspects of the green hydrogen supply chain, including production, storage, transportation, and utilization, and explores the techno-economic aspects relevant to each stage. Through hands-on examples, readers

understand how green hydrogen can be implemented across various applications. It explains Power-to-X technologies, which enable the conversion of green hydrogen into eco-friendly fuels and chemical feedstocks. Designed for students and researchers, this book simplifies complex concepts and comprehensively explains green hydrogen's benefits.

Features

- It covers the end-to-end green hydrogen and Power-to-X technologies (PtX) supply chain.
- Provides a holistic and integrated approach of theoretical and practical knowledge utilizing examples and various case studies from around the world.
- Demonstrates the global potential of green hydrogen with sector-specific applications and case studies.
- Includes cutting-edge and recent developments in the green hydrogen landscape with clear visuals and technical explanations.
- Discusses forward-looking evaluations of Power-to-X technologies, hydrogen safety, and green hydrogen techno-economic aspects.
- Written in simple, yet detailed language that serves well to a wide spectrum of readers.
- Tests readers' comprehension of the topics covered with self-assessment questions at the end of each chapter.

This textbook is an excellent foundational text for university students and researchers in Renewable Energy Engineering, Energy Systems Engineering, Chemical, Environmental, Mechanical Engineering, and Sustainable Development. It is also valuable to professionals in Energy, Heavy Industries, Chemical and Pharmaceutical sectors, and policymakers with a focus on innovative clean, renewable energy.

Techno-Socio-Economic Framework for Energy Storage System Selection in Jordan

2025/6/12

Energies

Renewable energy sources (RESs) are increasingly being recognized as sustainable and accessible alternatives for the energy future. However, their intermittent nature poses significant challenges to system reliability and stability, necessitating the integration of energy storage systems (ESSs) to ensure sustainability and dependability. This study examines various ESS alternatives, evaluating their suitability for different applications using a multi-criteria decision-making (MCDM) approach. The methodology accommodates diverse criteria types, including qualitative and quantitative factors, represented as linguistic terms, interval values, and crisp numerical data. A techno-socio-economic framework for ESS selection is proposed and applied to Jordan's unique energy landscape. This framework integrates technical performance, economic feasibility, and social considerations to identify suitable ESS solutions aligned with the country's renewable energy goals. The study ranks twelve energy storage systems (ESSs) based on key performance criteria. Pumped hydro storage (PHS), thermal energy storage (TES), supercapacitors (SCs), and lithium-ion batteries (Li-ion BESS) lead the ranking. These systems showed the best performance in terms of scalability, efficiency, and integration with grid-scale applications in Jordan. Key applications analyzed include renewable energy integration, grid stability, load shifting, peak load regulation, frequency regulation, and seasonal energy storage. Results indicate that Li-ion batteries are most suitable for renewable energy integration, while flywheels excel in grid stability and frequency regulation. PHS was found to be the preferred solution for load shifting, peak load regulation, and seasonal storage, with hydrogen storage emerging as a promising option for long-duration needs. These findings provide critical insights to guide policy and infrastructure planning, offering a robust model for comprehensive ESS assessment in energy transition planning for countries facing similar challenges.

Threat Analysis of Power System Case Study via STRIDE Threat Model in Digital Twin Real-time Platform

2025/6/30

The 5th International Conference on Electrical Sciences and Technologies in the Maghreb (CISTEM 2024)

Threat modeling is a pivotal analytical procedure employed to specify the potential threats and select the appropriate security measures. It helps reduce the risk of cyber-attacks that may target several components of the cyber-physical power systems. Accordingly, identifying potential cyber threats and assessing their consequences is an imperative aspect of the supervision and monitoring of power systems. This paper presents a threat analysis scheme of a power system case study utilizing the STRIDE threat model methodology. The developed model addresses several attack and threat scenarios combined into an attack graph model. In terms of security measures, this paper introduces a Secure, Encrypted, Authenticated Communication Channel (SEAC2), which is a two-level encryption method to secure the communication layer. Further, this study introduces an open-source Digital Twin (DT) platform that enables a real-time comprehensive assessment of the system's energy dynamics. It also prioritizes threat detection as another crucial aspect. A real case study from the Jordanian electrical network has been utilized in this study to validate the proposed platform.

The Potential of Green Hydrogen and Power-to-X to Decarbonize the Fertilizer Industry in Jordan

March.2025

Hydrogen Knowledge Centre and MDPI

Considering economic and environmental aspects, this study explored the potential of replacing urea imports in Jordan with local production utilizing green hydrogen, considering agricultural land distribution, fertilizer needs, and hydrogen demand. The analysis estimated the 2023 urea imports at approximately 13,991.37 tons and evaluated the corresponding costs under

various market scenarios. The cost of urea imports was projected to range between USD 6.30 million and USD 8.39 million; domestic production using green hydrogen would cost significantly more, ranging from USD 30.37 million to USD 70.85 million. Despite the economic challenges, transitioning to green hydrogen would achieve a 100% reduction in CO₂ emissions, eliminating 48,739.87 tons of CO₂ annually. Considering the Jordanian case, an SWOT analysis was conducted to highlight the potential transition strengths, such as environmental benefits and energy independence, alongside weaknesses, such as high initial costs and infrastructure gaps. A competitive analysis was conducted to determine the competition of green hydrogen-based ammonia compared to conventional methods. Further, the analysis identified opportunities, advancements in green hydrogen technology, and potential policy support. Threats were assessed considering global competition and market dynamics.

Sensitivity analysis of electrodes spacing media for evaluating alkaline electrolyzer performance through CFD modeling

2024

Renewable Energy Focus 49, 100575, Elsevier

Alkaline Water Electrolyzer (AWE) technology shows promising potential for shifting towards green hydrogen production. With the growing global interest in green hydrogen, understanding the dynamics of AWE systems becomes crucial to improving their performance. Therefore, this paper aims to provide a novel sensitivity analysis aspect to investigate the correlation within parameter variables associated with AWE's electrode separation media. These parameters include electrode-diaphragm gap, temperature, diaphragm thickness, and porosity, aiming to evaluate their impact on AWE current density. The methodology involves the development of a Computational Fluid Dynamics (CFD) model, conducting a parametric study, performing Analysis of Variance (ANOVA), and sensitivity testing within specified parameter ranges. The findings show that diaphragm porosity has a considerable effect, especially between 15 % and 60 % porosity, where the trend levels off at higher values. The electrode-diaphragm gap trend reveals a sensitive, nonlinear increase in cell current density as the gap decreases from its average, with a 75 % decrease yielding over 100 % higher current density, while adjustments beyond 10 mm have minimal impact on current density despite significant variations in other parameters. A 50 % temperature rise increases current density by 40 %, while a 50 % diaphragm width reduction modestly boosts current density by around 10 %. Understanding these sensitivities is vital for optimizing AWE's performance.

The Potential of Green Hydrogen and Power-to-X Utilization in Jordanian Industries: Opportunities and Future Prospects

2023

Energies 17 (1), 213, MDPI

Green hydrogen and power-to-X technologies hold significant potential in the global energy transition towards net-zero emissions. This is attributed to the premise that these technologies can decarbonize numerous sectors worldwide by providing versatile and sustainable energy carriers and industrial feedstocks to replace fossil-based fuels and chemicals. To this end, the qualitative benefits of green hydrogen and power-to-X technologies have been thoroughly examined for various applications in past years. In contrast, quantifying the potential penetration of such technologies on national and global levels still requires extensive research. Therefore, this paper investigates the prospective integration of green hydrogen and power-to-X technologies within Jordanian industries, considering their quantitative utilization potential for current and future capacities. The findings showed that the Jordanian food processing and heavy industries emerged as major sectors with substantial potential for incorporating green hydrogen and power-to-X products as alternative fuels or chemical feedstocks. In detail, the total potential utilization capacity for these sectors stood at around 57 thousand tons per year. Specifically, fertilizers production, cement industry, steel reforming, and oil refinery possess an annual potential capacity of around 6.8, 11.8, 12.7, and 25.8 thousand tons, respectively. It is also worth mentioning that the current utilization capacity of hydrogen in Jordanian industries was found to be around 8.9 thousand tons per annum, which is completely covered by fossil-based hydrogen to date. These results imply that there will be a promising market for green hydrogen and power-to-X utilization in Jordanian industries, which will play a significant role in integrated energy transition efforts in the future.

Real-Time Simulation and Energy Management Attainment of Microgrids

2023/2/2

MDPI

The rapid spread of Microgrid systems has led to the need for an intensive analysis of the system to avoid several challenges such as stability, reliability, power balance, and other aspects. In this context, real-time simulation plays a vital role in the overall system study before the actual implementation stage. This helps avoid many on-site problems of the Microgrid by simulating the system and studying different operation scenarios. This paper uses the OPAL-RT simulator to perform a real-time simulation of an MG case study. Furthermore, it examines the implementation of the Fault Ride Through technique to overcome the total disconnection of the PV system following unpredictable faults. Moreover, a Load curtailment solution method is proposed in this study, to meet the balance and stable operation of the MG. The results prove the effectiveness of both techniques, with FRT implementation reducing the losses by about 62%, and the Load curtailment algorithm maintaining the balance of the MG.

An adaptive approach-based ensemble for 1 day-ahead production prediction of solar PV systems

2022/3/22

Advances in Mechanical Engineering

The world is becoming more reliant on renewable energy sources to satisfy its growing energy demand. The primary disadvantage of such sources is their significant uncertainty in power production. As appropriate energy production planning and scheduling necessitate a solid and confident assessment of renewable power production, the necessity for developing reliable prediction models grows by the day. This paper proposes an adaptive approach-based ensemble for 1-day ahead prediction of solar Photovoltaic (PV) systems. Different ensembles of Artificial Neural Networks (ANNs) prediction models are established, whose architectures (number of the ANNs that comprise the ensembles) and configurations (number of hidden nodes required by the ANNs models of the ensembles) change adaptively at each hour h , $h \in [1, 24]$ of a day, for accommodating the hour seasonality in the solar PV data and, thus, enhancing the 1 day-ahead predictions accuracy. The suggested approach is tested on a 264 kW solar PV system installed at Applied Science Private University, Jordan. Its prediction performance is evaluated, particularly for different weather conditions (seasons) experienced by the concerned PV system, using standard performance metrics. Results show the effectiveness of the suggested approach in predicting solar PV power production and its superiority compared to another prediction approach of the literature that uses single ANNs at each hour h of the day. Specifically, for 1-day ahead prediction, the obtained enhanced accuracy, on average, was around 8%–10% on the test “unseen” datasets.

Business Model of Peer-to-Peer Energy Trading: A Review of Literature

2022/1/29

Sustainability

Peer-to-peer (P2P) energy trading is a promising energy trading mechanism due to the deployment of distributed energy resources in recent years. Trading energy between prosumers and consumers in the local energy market is undergoing massive research and development, paying significant attention to the business model of the energy market. In this paper, an extensive review was conducted on the current research in P2P energy trading to understand the business layer of the energy market concerning business model dimensions: bidding strategies and the market-clearing approach. Different types of game theoretical-based and auction-based market-clearing mechanisms are investigated, including a detailed classification of auctions. This study considers the possibility of employing the P2P technique in developing countries and reviewing existing business models and trading policies. The business layer of the P2P structure plays a vital role in developing an effective trading mechanism based on interactive energy markets.

A New Configuration of Roof Photovoltaic System for Limited Area Applications—A Case Study in KSA

2022/1/19

Buildings

Increased world energy demand necessitates looking for appropriate alternatives to oil and fossil fuel. Countries encourage institutions and households to create their own photovoltaic (PV) systems to reduce spending money in electricity sectors and address environmental issues. Due to high solar radiation in the Kingdom of Saudi Arabia (KSA), the government urges people and institutions to establish PV systems as the best promising renewable energy resource in the country. This paper presents an optimal and complete design of a 300 kW PV system installed in a limited rooftop area to feed the needs of the Ministry of Electricity building, which has a high energy consumption. The design has been suggested for two scenarios in terms of adjusting the orientation angles. The available rooftop area allowed to be used is insufficient if a tilt angle of 22° is used, suggested by the designer, so the tilt angle has been adjusted from 22° to 15° to accommodate the available area and meet the required demand with a minimum shading effect. The authors of this paper propose a modified scenario “third scenario” which accommodates the available area and provides more energy than the installed “second scenario”. The proposed panel distribution and the estimated energy for all scenarios are presented in the paper. The possibility of changing tilt angles and the extent of energy production variations are also discussed. Finally, a comparative study between measured and simulated energy is included. The results show that August has the lowest percentage error, with a value of 2.7%, while the highest percentage error was noticed in November.

Competencies of Fault Ride Through in Microgrid Modeling: A Case Study

2021/11/16

2021 IEEE Jordan International Joint Conference on Electrical Engineering and Information Technology (JEEIT)

Microgrid systems effectively integrate a generation mix of solar, wind, and other renewable energy resources. However, the unpredictable faults and power shortage cases contribute primarily to the unreliable operation of microgrid networks. Fault Ride Through is considered one of the vital techniques towards maintaining a reliable and efficient operation of the power systems under fault cases. This paper aims to investigate and study the Fault Ride Through capability for different Microgrid topologies. In this study, Microgrid and Fault Ride Through models have been built in order to study the behavior of this technique on keeping the installed renewable energy resources connected to the Microgrid system. Results emphasize the functional operation of the proposed Fault Ride Through technique and its impact on operational cost reduction by avoiding the PV interruptions. A losses reduction of about 38% of the output power of the PV system is achieved by applying the Fault

Ride Through technique on the Microgrid system, compared to a total cut of the PV system in the case of the regular operation without Fault Ride Through. The implementation of this technique can lead to saving an operational cost of around 327317 \$ per year.

Analysis and Simulation of Maximum Power Point Tracking Based on Gradient Ascent Method

2021/4/14

2021 12th International Renewable Engineering Conference (IREC)

This paper aims to implement the gradient ascent algorithm for maximum power point tracking (MPPT) in a photovoltaic (PV) system. The proposed MPPT algorithm will ensure the PV module's operation at the maximum power point by finding the optimal duty cycle that corresponds to each time step. The gradient ascent algorithm is an iterative method, and it is one of the most popular machine learning optimization algorithms. The gradient ascent is used for the first-order optimization, which means it only takes the first derivative into account when doing the parameter updates. On each iteration, the parameters have been changed in the opposite direction of the objective function gradient. Steps proportional to the positive gradient have been applied to find a local maximum of the function. This function has been implemented in a PV model to investigate the gradient ascent algorithm's applicability as an MPPT

Robust Channel Assignment for Hybrid NOMA Systems with Condition Number Constrained DRL

2021/11/19

2021 International Conference on Networking Systems of AI (INSAI)

The Hybrid Non-Orthogonal Multiple Access (NOMA) is an alternative solution for future multiple access techniques, and the performance of hybrid NOMA systems relies on the quality of channel assignment. Conventional optimization approaches rely on the perfect Channel State Information (CSI), which hinders the deployment of the Hybrid systems. Deep Reinforcement Learning (DRL) approaches are robust to uncertain environments, and have been applied to deal with the dynamic channel assignment in hybrid NOMA systems. In this paper, a novel DRL approach based on condition number constraint is proposed to further enhance the robustness of the model. The simulation results show that the proposed approach achieves higher average spectral efficiency under imperfect CSI, compared to unconstrained DRL approaches and conventional approaches. This is useful for critical infrastructure systems such as base stations that require a high degree of robustness.

Competencies of Fault Ride Through in Microgrid Modeling: A Case Study

Accepted Oct.2021

IEEE

Algorithm Design for Accurate Steps Counting Based on Smartphone Sensors for Indoor Applications

Nov. 2020

Adv. Sci. Technol. Eng. Syst. J. , ASTES Publishers

Abstract: this paper aims to design an accurate and robust algorithm for counting the steps based on the smartphone's accelerometer for indoor applications. Different daily activities have been considered in the experimental scenarios, including normal walking with various smartphone positions and running activities. The detection process's accuracy is ensured by setting an appropriate segregation approach and defining a fixed threshold for each experiment. The algorithm generates a new envelope signal that mimics the collected steps signal without the vibrations and noise elements to avoid miscounting the exact steps. The followed approach results have been compared with the pedometer applications on the android platform and HUAWEI Watch GT-731. The proposed algorithm showed improved detection accuracy in contrast to the other literature approaches. The obtained accuracy was around 99% for the standard walking scenario and approximately 97% for the running activity scenario.

Optimal PV Size and Location to Reduce Active Power Losses While Achieving Very High Penetration Level with Improvement in Voltage Profile Using Modified Jaya Algorithm

June. 2020

EEE Journal of Photovoltaics

Abstract: In this article, a new multiobjective algorithm is proposed for determining the optimal sizing and allocation of the photovoltaic (PV) systems in radial distribution systems. A Jaya algorithm is modified to find the optimal PV capacities for limited bus locations at the network. The proposed algorithm showed better performance against known techniques, and the results are presented. Besides, a new distinguished methodology is improved and developed based on the Jaya Algorithm to find the optimum capacity of each PV system that satisfies an improvement of the voltage profile and reduces power losses under high penetration levels. Also, optimum capacities are determined by considering the connection of the PV systems for all buses along with the network. Furthermore, the proposed method is verified on the standard IEEE-33 bus test system with high penetration rates. Simulation and validation are obtained by MATPOWER and OCTAVE software.

Small Wind Turbine Blade Design and Optimization

Dec. 2019

Symmetry, MDPI

Abstract: This work aims at designing and optimizing the performance of a small Horizontal-Axis-Wind-Turbine to obtain a power coefficient (C_p) higher than 40% at a low wind speed of 5 m/s. Two symmetric in shape airfoils were used to get the final optimized airfoil. The main objective is to optimize the blade parameters that influence the design of the blade since the small turbines are prone to show low performance due to the low Reynolds number as a result of the small size of the rotor and the low wind speed. Therefore, the optimization process will select different airfoils and extract their performance at the design conditions to find the best sections which form the optimal design of the blade. The sections of the blade in the final version mainly consist of two different sections belong to S1210 and S1223 airfoils. The optimization process goes further by investigating the performance of the final design, and it employs the blade element momentum theory to enhance the design. Finally, the rotor-design was obtained, which consists of three blades with a diameter of 4 m, a hub of 20 cm radius, a tip-speed ratio of 6.5 and can obtain about 650 W with a Power coefficient of 0.445 at a wind-speed of 5.5 m/s, reaching a power of 1.18 kW and a power coefficient of 0.40 at a wind-speed of 7 m/s.

Turbine Design and Its Impact on Energy Harvesting From In pipe Hydro Systems

Sep. 2019

International Journal of Mechanical Engineering and Robotics Research

Abstract: This paper aims at investigating the impact of the utilized turbine design on the harvested energy from in-pipe systems. Four turbine designs are involved in this study which includes the spherical turbine and the Helical (Egg Beater) with three blades, four blades, and five blades. The proposed turbines are designed and they have been implemented in a prototype to determine the performance of each design. The study presents design procedures and the design requirements of each employed turbine before the implementation phase. The next step is to collect the produced torque, rotational speed, pressure drop, and output power for each turbine experimentally. The results have been analyzed and compared to show the design impact on these parameters. Finally, a case study is carried out on the major water distribution network in Amman the capital of Jordan to determine the possible locations, which are benefited from the implementation of the in-pipe system with the examined turbines.

Optimized Modeling of Ni-Mh Batteries Primarily Based on Taguchi Approach and Evaluation of Used Ni-Mh Batteries

Jan. 2019

Turkish Journal of Electrical Engineering & Computer Sciences

Abstract: This paper aims to generate an optimized model of the Ni-MH battery based on the Taguchi method and it further aims to evaluate used Ni-MH batteries that served in hybrid electric vehicles and electric vehicles. The status of twelve used Ni-MH batteries is studied to determine their usefulness after their life cycle in automotive applications. The status of used batteries is evaluated by investigating their state of charge, remaining useful life, and degradation in performance. Accordingly, the tested batteries are classified into four categories and they are proposed to serve in different applications. The novelty of the work lies in modeling used Ni-MH hybrid batteries by extracting a model that can define and calculate the battery voltage during the discharging phase, and it can study the influence of design parameters under certain conditions regardless of whether the battery is brand-new or used. Therefore, a second-order model is used to represent the used battery where an explicit mathematical formula expresses the discharge voltage of the new Ni-MH battery at different discharge pulse times, optimized later utilizing the Taguchi optimization method. Finally, the discharge voltage obtained using the developed model for different batteries is benchmarked against the actual measured discharge voltage by calculating the root mean square error.

Evaluating and Repurposing of Used Ni-Mh Hybrid Batteries

Oct. 2018

International Renewable and Sustainable Energy Conference (IRSEC). IEEE

Abstract: This paper aims at evaluating and repurposing of the used Ni-MH hybrid batteries after their life-cycle in the hybrid electric vehicles application. This process passes through two main steps, which starts by determining the state of these batteries and analyzing their behavior during the charging and discharging cycles. The work extends to show the maximum attainable power and determines the Remaining Useful Life of the used batteries by applying non-destructive tests. The next step is to maximize the obtained power and to investigate the durability of the batteries by analyzing the degradation of the used Ni-MH batteries. In addition, the applicability of the used batteries for different load scenarios will be presented.

Engineering-Based Economical Evaluation of The Retired Ni-Mh Batteries From Electric And Hybrid electric Vehicles In Jordan

Oct. 2017

Australian Journal of Basic and Applied Sciences

Abstract: Driven by energy-conscious consumption, Jordan is continuously migrating towards hybrid and electric-hybrid solutions in terms of transportation vehicles. This created an abundance of retired batteries which are either stacked in warehouses and/or about to be illegally disposed of. This require economically feasible post- automotive solutions to avoid this environmentally harmful disposal. This paper presents an engineering-based (experimentally verified) economical

evaluation of retired NiMH batteries. This process passes through two main steps, which starts by determining the state of these batteries and analyzing their behavior during the charging and discharging cycles. The work extends to show the maximum attainable power and determines the Remaining Useful Life of the used batteries by applying non-destructive tests. The retired batteries were found to be diverse in their potential, where a non-negligible share (40%) of them can still be repurposed in secondary applications.

OTHER PUBLICATIONS

Roadmap to Transit the Electrical Grid to a Secure Smart Grid: A Collaborative Approach for Regulatory and Governmental Reforms in the Kingdom of Jordan preprint

2023

This policy paper explores various strategies that would facilitate transitioning the traditional Jordanian electrical grid to a secure smart grid. It includes comprehensive recommendations from academia and industry for the regulatory and governmental sector in Jordan to achieve specific roadmap objectives. As Jordan is heavily dependent on fossil fuels, This policy paper also provides recommendations for incorporating more renewables into its energy mix, thereby facilitating a sustainable future. The proposed policies will emphasise the creation of an enabling environment where innovation, research, and development initiatives flourish, thereby promoting private sector engagement.

The Methodology of Insertion of Smart Grid and Grid Connected Systems in Education

Jul 2018

Erasmus+ project No. 585648- EPP-1-2017-1-UKEPPKA2-CBHE-JP

Current Situation and Need for Smart Grid Education Program

Jun 2018

Erasmus+ project No. 585648- EPP-1-2017-1-UKEPPKA2-CBHE-JP

Smart Grids Survey Report Target Group: Universities Teaching Staff in (Mena Region)

Jun 2018

Erasmus+ project No. 585648- EPP-1-2017-1-UKEPPKA2-CBHE-JP

Smart Grids Survey Report Target Group: University Staff (European Region)

Jul 2018

Erasmus+ project No. 585648- EPP-1-2017-1-UKEPPKA2-CBHE-JP

Smart Grids Survey Report Target Group: Stakeholders

Oct 2020

Erasmus+ project No. 585648- EPP-1-2017-1-UKEPPKA2-CBHE-JP

Smart Grids Survey Report Target Group: Students

Sep 2018

Erasmus+ project No. 585648- EPP-1-2017-1-UKEPPKA2-CBHE-JP

Report of Special Training Session of AT- SGIRES Project for the Syrian Partners Conducted by German Jordanian University and University of Newcastle

Mar 2020

Erasmus+ project No. 585648- EPP-1-2017-1-UKEPPKA2-CBHE-JP

Course Module: Technological Innovation on Smart Grids and Renewable Energy Sources

Jan 2019 - Jun 2020

Erasmus+ project No. 585648- EPP-1-2017-1-UKEPPKA2-CBHE-JP

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