2024 IEEE 8th Energy Conference (ENERGYCON 2024)

Doha, Qatar
4 – 7 March 2024

IEEE Catalog Number: CFP2433M-POD
ISBN: 979-8-3503-8216-7

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number: CFP2433M-POD
ISBN (Print-On-Demand): 979-8-3503-8216-7
ISBN (Online): 979-8-3503-8215-0

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IEEE-ENERGYCON 2024

Program

Monday, March 4

Monday, March 4, 10:00 - 11:00

K1: Keynote Speaker Session 1

- **Robust Volt-Var Control in Power Distribution System**
- **Bikash Pal, Professor, Imperial College London (ICL), UK**
- **Room: I11- Auditorium**

Electrical generation, transmission, and distribution systems all over the world have entered a period of significant renewal and technological change. There have been phenomenal changes/deployments in the technology of generation, driven by the worldwide emphasis on energy from wind and solar as a sustainable solution to our energy needs. Increasingly, energy demand from heating and transportation is being met by electricity. These changes have significantly influenced the planning, design, operation, and control of the power distribution system. Accommodating uncertainties in renewable generation and demand forecast in a cost-effective manner is now a very complex optimization problem. This talk will share our recent research efforts on the Volt/VAr Control (VVC) strategy in distribution systems to address the uncertainties. The efficient chance-constrained conic optimisation technique accelerated through a scenario reduction approach will be discussed to demonstrate the significant reduction of voltage violations when compared with the deterministic cases while not relaxing the conservativeness of the final solutions. It will also touch upon the treatment of certain types of load characteristics in the proposed solution framework. Future research challenges and opportunities will be highlighted.

Monday, March 4, 11:00 - 12:00

K2: Keynote Speaker Session 2

- **99.9% Class Efficiency DC-AC Power Conversion and Its Application to Grid Interconnection**
- **Atsuo Kawamura, Yokohama National University**
- **Room: I11- Auditorium**

With the advent of wide-bandgap semiconductor devices, power conversion with high conversion efficiency has become possible. The DC-AC power conversion (inverter) is more difficult to achieve ultra-high efficiency than the DC-DC conversion because the output is AC and the input-output voltage ratio changes. First, a survey of recent published literature on inverters with efficiencies in the 99.9% class is presented. Next, the speaker presents the latest results of a 99.9%-class HEECS inverter being pursued by the speakers' group. With higher efficiency comes the need to guarantee the accuracy of the measurements. The speaker proposed a loss measurement method called the VTASLM method, which uses only electrical measuring instruments and measures a conversion efficiency of 99.75% with a measurement accuracy of 0.006%. In addition, the measured results of the loss breakdown are presented, a methodology on how to obtain higher efficiency is presented, and the latest highest efficiency data (SiC and GaN HEECS inverters) will be presented. Finally, as one application, grid-interconnected HEECS inverters are introduced for renewal energy, and it is shown that leading and lagging power factor operations are realized by the proposed control.

Monday, March 4, 14:00 - 15:15

TUT1: Tutorial 1 - Impulsive Noise in PLC

- **Impulsive Noise Mitigations in Powerline communications**
- **Dr. Arafat Al-Dweik**
- **Room: I11-C243**

Abstract: Powerline communications (PLC) is vital for leveraging existing electrical infrastructure, offering cost-effective and reliable connectivity. By utilizing established power lines, PLC eliminates the need for additional cabling, making it particularly advantageous in areas where deploying new infrastructure is impractical or expensive. This accessibility extends connectivity to remote regions or places with poor wireless coverage. Moreover, PLC ensures reliability, as power lines are typically well-maintained and less susceptible to interference compared to wireless signals. Its interoperability enables seamless integration with existing networks, supporting various applications such as smart grid management, home automation, and industrial control systems. Advancements in PLC technology have led to significant improvements in data transmission speeds, enabling high-speed internet access and multimedia streaming. The PLC channels typically suffer several factors that limit its performance, which includes, fading due reflections through multiple routes and impulsive noise due to interference that travels along the power lines, often caused by fluctuations in voltage, switching operations of electrical devices, or harmonics generated by nonlinear loads like electronic equipment. Both fading and impulsive noise can degrade the quality of PLC signals and reduce the effectiveness of data transmission. To mitigate these issues, various techniques such as signal filtering, error correction algorithms, and frequency hopping spread spectrum (FHSS) modulation are employed in PLC systems to suppress noise and improve communication reliability. This tutorial aims at describing the basics of PLC systems, discuss the main channel models, and present state of the art impulsive noise mitigation schemes.

Monday, March 4, 14:00 - 15:15

TUT2: Tutorial 2 - Design and Control of EVs

- **Design and Control of Electric Vehicle (EV) Chargers and their Impacts on Power Distribution Network**
- **Dr. Atif Iqbal, Dr. Shirazul Islam, Dr. Sheetal Deshmukh**
- **Room: I11-C245**

Abstract: Electric vehicles (EVs) are gaining traction worldwide as a sustainable alternative to conventional internal combustion engine vehicles. However, the widespread adoption of EVs poses significant challenges to the utility grid, particularly in terms of load management, peak demand, and grid stability. The vehicle-to-grid (V2G) functionality is used to supply various services like regulation of active power demand, reactive power compensation, shaving peaks and filling valleys in load demand, frequency and voltage regulation, compensation of harmonics in grid current, improvement in system reliability, stability, and efficiency. This tutorial will provide a comprehensive overview of EV charger design and control techniques to ensure grid-to-vehicle (G2V) and V2G modes of operation. Further, the integration of EV chargers into the existing grid may lead to drop in voltage profile of various buses which deteriorate the hosting capacity of the existing power system network to accommodate EVs. In this tutorial, the various techniques which are used to assess the hosting capacity of the power system network will be discussed. This tutorial aims to delve into the intricacies of designing and controlling Electric Vehicle (EV) chargers, focusing on their profound impact on the utility grid. With the rapid proliferation of electric vehicles, the efficient integration of charging infrastructure into the existing distribution network is paramount. This tutorial will explore various aspects including charger design, smart charging strategies, integration challenges, and solutions to ensure a harmonious relationship between EV charging and the distribution network. Complete design guidelines for EV charger will be elaborated. Different control methodologies and controller design will be illustrated. Simulation and experimental results will be shared. A case study of Kahramaa power distribution network will be discussed to understand the major impact of EV charger integration.

Monday, March 4, 15:30 - 17:10

T1.1: Power System Stability, Protection and Control

- **Room: I11-C243**
- **Chair: Nader Meskin (Qatar University & Concordia University, Qatar)**

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Tuesday, March 5

Tuesday, March 5, 8:30 - 9:50

T4.2: Energy Economics, Policy and Management

- **Room: I11-C243**
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Tuesday, March 5, 8:30 - 9:50

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- **Room: I11-C245**
- **Chairs: Faycal Bensaali (Qatar University, Qatar), Ermanno Cardelli (University of Perugia, Italy)**

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Tuesday, March 5, 8:30 - 9:50

T8.1: Industrial Automation and Robotics

- **Room: I11-C244**
- **Chairs: Mohamed zied Chaari (Qatar University & Qatar, Qatar), Mohamed Gharib (Texas A&M University, USA)**

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Tuesday, March 5, 10:00 - 11:00

K3: Keynote Speaker Session 3

- **Iberdrola: Digital Innovation in Energy: A Key Sustainability Driver**
- **Santiago Bañales, Managing Director of Iberdrola Innovation Middle East**
- **Room: I11-C243**

The current energy transition entails two key developments in the sector: a radical increase in the share of renewable energy, mainly solar and wind power, in the final energy mix and the electrification of demand, in particular the transportation, heating, and industrial sectors. This keynote will showcase how digital technologies such as Artificial Intelligence, Machine Learning, Cloud and Edge computing are being used by energy industry leaders to improve the productivity of generation and electrical network assets, increase the penetration of renewables in the energy system, and provide tools to the final customer to be an active player in the energy transition.

Tuesday, March 5, 11:00 - 12:00

P1: Panel 1 - Digital Energy Products

- **Carlos Pascual, Iberdrola Customers Spain; Rafael Bellido, Global Energy Management; Dr. Luis Prieto, Renewables Global Operations & Maintenance; Dr. Daniel Paredes, Renewables Global Engineering;**
- **Moderated by: Dr. Javier Hernandez (Iberdrola Innovation ME - Technical Director)**
- **Room: I11-C243**

Explore the evolving landscape of the energy sector in the Digital Energy Products panel, where industry leaders, including Carlos Pascual from Iberdrola Customers Spain, Rafael Bellido from Global Energy Management, and Drs. Luis Prieto and Daniel Paredes from Renewables Global Operations & Maintenance and Global Engineering, share insights. Moderated by Dr. Javier Hernandez, Technical Director at Iberdrola Innovation ME, this discussion delves into the challenges, innovations, and trends shaping digital energy products and services.

Tuesday, March 5, 14:00 - 15:40

T2.2: Renewable Energy and Distributed Generation Systems

- **Room: I11-C243**
- **Chairs: Hassan Ali (UDST, Qatar), Hasan Dinçer (Istanbul Medipol University, Turkey)**

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Tuesday, March 5, 14:00 - 15:40

T5.1: Smart Grid Technologies and Security

- **Room: I11-C244**
- **Chairs: Arafat Al-Dweik (Khalifa University, United Arab Emirates), Ayman Al-Kababji (Iberdrola Innovation Middle East, Qatar)**

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Wednesday, March 6

Wednesday, March 6, 8:30 - 10:10

T5.2: Smart Grid Technologies and Security

- **Room: I11-C243**
- **Chairs: Qutaibah Malluhi (Qatar University, Qatar), Emanuele G.C. Ogliari (Politecnico di Milano, Italy)**

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Wednesday, March 6, 8:30 - 10:10

T6.1: Power Electronics and Energy Conversion

- **Room: I11-C245**
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T9.1: Vehicular Technology

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Wednesday, March 6, 10:30 - 11:45

P2: Panel 2 - Electrical Vehicles

- **Dr. Sertac Bayhan, Qatar Environment and Energy Research Institute (QEERI); Sr. Engr. Mohammed Al, Sharshani, Kahramaa; Dr. Arantxa Otiz Marina, Iberdrola Innovation Middle east; Er. Sherif Salah, Eldin Elsafty, Mowasalat;**
- **Moderator: Prof. Atif Iqbal, Qatar University**
- **Room: I11-C245**

Explore the forefront of sustainable mobility in Qatar at our panel discussion, featuring insights from leading experts in the field. Esteemed speakers from Alfardan Automotive, Kahramaa, the Qatar Environment and Energy Research Institute (QEERI), and Mowasalat, with moderation by

Qatar University's Prof. Atif Iqbal, will delve into the challenges, innovations, and strategies vital for the growth of the electric vehicle market. This event is a must-attend for those committed to the development of a cleaner, more sustainable transportation ecosystem.

Wednesday, March 6, 10:30 - 11:45

P3: Panel 3 - Women Driving Change in Energy Engineering

- **WIE: Empowering Tomorrow: Women Driving Change in Energy Engineering**
- **Dr. Noora Fetais, Wafa Ben Hmida, Shahd Gaben, Samara Waheed,**
- **Moderated by Leila Gastli**
- **Room: I11-C244**

Join us for a dynamic and insightful panel discussion at the upcoming energy conference, where we will spotlight the invaluable contributions of women in engineering to the ever-evolving energy landscape. Our panel, titled "Empowering Tomorrow: Women Driving Change in Energy Engineering," aims to explore the diverse perspectives, innovative solutions, and leadership roles that women bring to the field. In this engaging session, accomplished women engineers from various sectors of the energy industry will share their experiences, challenges, and successes. From renewable energy to sustainable practices, our panelists will discuss the pivotal role women play in shaping the future of energy engineering. Topics will include fostering diversity and inclusion, overcoming gender biases, and the importance of mentorship in cultivating the next generation of female engineers. By highlighting the achievements of women in energy engineering, we hope to inspire and encourage more individuals to pursue careers in this dynamic field. Join us for an empowering conversation that celebrates the incredible impact of women on the forefront of innovation, driving positive change for a sustainable and inclusive energy future.

Wednesday, March 6, 14:00 - 15:20

T3.1: Energy Storage Technology and Renewable Energy

- **Room: I11-C243**
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Wednesday, March 6, 14:00 - 15:20

T6.2: Energy Harvesting, Power Management, and Secure IoT

- **Room: I11-C245**
- **Chairs: Som Jairaj Ankar (National Institute of Technology Tiruchirappalli India, India), Rosemizi Abd Rahim (Universiti Malaysia Perlis, Malaysia)**

- **14:00** ***Modeling and Analysis of Piezoelectric Cantilever for Kinetic Ambient Energy Harvesting...327***
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