IEEE Queensland Section

IEEE QLD PEL/IE/IA Joint Societies Chapter PhD Symposium

We are pleased to inform you that PEL/IE/IA societies joint chapter of IEEE Queensland section, QUT School of Electrical Engineering and Robotics and Griffith University jointly organize an online PhD symposium on "Power Electronics and Power Systems".

Date: 26th of June 2020

Time: 2:00 pm to 4:00 pm

Zoom ID - https://qut.zoom.us/j/8566366508

The speakers are six outstanding PhD students from Queensland University of Technology and Griffith University who are presenting their research findings in 10 minutes with 5 minutes Q&A.

Your presence and valuable comments would be greatly appreciated.

Schedule of this symposium, topics and biographies for each speaker are as follows.

Schedule

Farzad Farajizadeh
[2:00 pm- 2:15 pm]

Modelling, Analysis, and Control of Compensation Networks in Inductive Power Transfer Systems

Babak Jeddi
[2:45 pm – 3:00 pm]

Distributed Energy Management for a Coordinated Load Scheduling in Residential Neighbourhoods

Amir Hakemibarabadi
[2:15 pm- 2:30 pm]

Wireless Power Transfer for Ventricular Assist Devices

Nadia Afrin
[3:00 pm- 3:15 pm]

Dynamic Voltage Stability Improvement of Islanded Microgrid

Dulmini Karunathilake
[2:30 pm- 2:45 pm]

Health Conscious Optimal Control of Lithium-Ion Batteries

Usman Bashir Tayab
[3:15 pm- 3:30 pm]

Energy Management System for a Grid-Connected Microgrid with Photovoltaic and Battery Energy Storage System

TOPIC_1 [2:00 pm – 2:15 pm]:

Modelling, Analysis, and Control of Compensation Networks in Inductive Power Transfer Systems

ABSTRACT:

To design an integrated expandable Wireless Power Transfer (WPT) system to make the transmission of power to electric vehicle end-users more efficient and manageable is the main aim of this research. In this seminar, some techniques for compensation of multi-transmitter WPT systems, suppression of mode-changing transients, estimation of the transferred power, and control of the transferred power with the use of PWM synchronized sampling have been proposed. The integrated system forms a multi-coil WPT system, in which all the coils should communicate with each other, and transmitter coils should be able to measure and control the rate of the transferred power. During this process, the control centers should track the identification code of a particular EV, communicate with the receivers and transmitters, and based on the measured transferred power, charge the end-user according to energy tariff.

SPEAKER:

Farzad Faradjizadeh (Farajizadeh) (S'14) received the B.Sc. degree in electrical engineering from the Azad University of Gonabad, Iran, in 2009, and the M.Sc. degree in electrical engineering from the Azad University of Tehran, Tehran, Iran, in 2010. He is currently working toward the Ph.D. degree at Queensland University of Technology, Brisbane, QLD, Australia. His current research interests include wireless power transfer systems, power electronic converters, machine drives, FACTs, and renewable energy conversion.

TOPIC_2 [2:15 pm – 2:30 pm]:

Wireless Power Transfer for Ventricular Assist Devices

ABSTRACT:

Heart diseases (HDs) are one of the leading causes of death rate in developed countries. In the last two decades, considerable advances in mechanical heart pumps provided favourable therapeutic treatment for the end-stage patients with heart failure. Among mechanical solutions, ventricular assist devices (VADs) are a prevalent therapy which help to compensate blood circulation deficiency caused by weakened ventricle muscle. Infection incident risk up to 60% is one of the major complications in the commercial VAD systems which is mainly caused by percutaneous driveline. To tackle the aforementioned issue, there is an ongoing investigation toward utilization of wireless power transfer (WPT) system for supplying the implemented heart pump. Due to restrictions and the structure of required system, significant considerations must be taken into account at the design stage such as system efficiency, reliability and size. This work studies the novel control methods based on the robust controller methods to increase reliability and efficiency at the same time.

SPEAKER:

Amir Hakemibarabadi received the B.Sc. and M.Sc. degree in electrical engineering from Ferdowsi University of Mashhad, Iran, in 2014 and 2017 respectively. He is currently working towards the PhD degree in department of electrical engineering and robotics, Queensland University of Technology (QUT). His research interests include power electronics converters, wireless power transfer systems, motor drives, robust control techniques, impedance networks, and matrix converters.

TOPIC_3 [2:30 pm – 2:45 pm]:

Health Conscious Optimal Control of Lithium-Ion Batteries

ABSTRACT:

Battery Energy Storage Systems (BESS) can be used as a carbon-free source which integrates the highly intermittent renewable energy sources such as wind and solar to the power system and to utilize the generated assets effectively. Lithium-ion batteries are ideal for use in these BESS for the integration of renewables as they can cope effectively with short-term and long-term variabilities of solar and wind resources among many other advantages. A degradation-conscious-physics-based Equivalent Circuit Model (ECM) is used as the fundamental block which models the internal physics of the Lithium-ion cell mathematically while ensuring less computational effort and easy implementation using passive elements. An Advanced Battery Management System is to be developed which performs cell parameter identification, individual control and monitoring of cells using modular multilevel series-parallel configuration. Further, to achieve a health-conscious optimal control that increases energy transfer efficiency, utilization of battery capacity, battery lifetime while minimizing battery degradation and computational cost for a BESS.

SPEAKER:

Dulmini Karunathilake received her B.Sc. degree in electrical and electronic engineering from the University of Peradeniya, Sri Lanka, in 2015. She has 3-years of industrial experience in electrical and telecommunication industries in Sri Lanka. Currently she is a Ph.D. Research student at School of Electrical Engineering & Robotics, QUT. Her areas of interest are Lithium ion battery modelling, Battery Management Systems and Health conscious optimal control of batteries.

TOPIC_4 [2:45 pm – 3:00 pm]:

Distributed Energy Management for a Coordinated Load Scheduling in Residential Neighbourhoods

ABSTRACT:

In recent years, home energy management systems (HEMS) are gaining more popularity. A HEMS finds the best scheduling for the operation of appliances given the electricity prices, operational constraints of appliances, and comfort level of the occupants to minimize the electricity bill. When a group of HEMS works independently under the same price scheme, some new challenges such as "rebound peaks" and constraints violation might be created for the network operation. This research, therefore, aims to develop a coordinated framework for the operation of multiple HEMS in a residential neighbourhood based on the optimal and secure operation of the grid. The coordinated load scheduling framework enables customers to cooperate to optimize energy consumption at the neighbourhood level and prevents any limitation violation in the operational constraints. At the same time, it financially benefits customers for their participation in the coordinated consumption program by reducing their electricity payment.

SPEAKER:

Babak Jeddi is an under-examination PhD student at the Queensland University of Technology. He received his B.Sc. and M.Sc. degree both in electrical power engineering in 2011 and 2013, respectively. His research interests include various aspects of power and energy systems including network integration of distributed energy resources (renewables, storage, and electric vehicles), smart distribution networks, demand response, electricity market, and power system reliability assessment. He has been involved in teaching some undergraduate units and managing several groups of students at QUT for 3 years and is an Associate Fellow of the UK Higher Education Academy.

TOPIC_5 [3:00 pm – 3:15 pm]:

Dynamic Voltage Stability Improvement of Islanded Microgrid

ABSTRACT:

The unique intrinsic features and systemic differences of microgrid (MG) makes the islanded mode operation more challenging than conventional power system. Though the nearer presence of generating unit to the load in a MG is an advantageous feature to transfer the reactive power, the lower short circuit capacity of voltage source converter (VSC) compared to synchronous generator makes the voltage stability a crucial factor. Moreover, low or medium voltage MGs contain considerable resistive line parameters. Hence, active current is also required in conjunction with reactive current during voltage sag. However, the effective coordination of active and reactive current injection following a disturbance depends on many factors including the dynamics of MG and an extensive analysis is required to determine, which has become an obligatory concern both for academia and industry. Considering aforementioned issues, improved voltage support strategy for VSC to enhance the dynamic voltage stability of islanded MG is proposed.

SPEAKER:

Nadia Afrin received both the B.Sc. and M.Sc. degrees in Electrical and Electronic Engineering from Rajshahi University of Engineering and Technology, Bangladesh, in 2012 and 2017, respectively. She is currently working toward the Ph.D. degree in the school of Engineering and Built Environment, Griffith University. After completing the Bachelor's degree, she served as Lecturer and then Assistant Professor at the Department of Electrical and Electronic Engineering, Pabna University of Science and Technology, Bangladesh. Her research interests include renewable energy integration, micro grids, voltage source converter, and voltage stability.

TOPIC_6 [3:15 pm – 3:30 pm]:

Energy Management System for a Grid-Connected Microgrid with Photovoltaic and Battery Energy Storage System

ABSTRACT:

A microgrid (MG) is an energy system composed of renewable resources, energy storage unit and loads that can operate in either islanded or grid-connected mode. Renewable resources should be scheduled to manage load demand and power flow within MG. This research work presents a MG energy management system (M-EMS) for grid-connected photovoltaic (PV) and battery energy storage system (BESS) based hybrid MG. The proposed M-EMS consists of two modules, namely, forecasting and optimisation. The forecasting module is responsible for predicting solar irradiation, temperature and load demand, whereas the optimisation module performs optimal day-ahead scheduling of power generation and load demand in a grid-connected MG for economical operation. The proposed M-EMS for grid-connected hybrid PV-BESS MG will be verified using MATLAB-Simulink and small-scale experimental setup at Griffith University. Simulation and experimental results indicate the efficiency and effectiveness of the proposed method for understudy case.

SPEAKER:

Usman Bashir Tayab received the B.Eng (Hons) Electrical and Electronic from University of Sunderland, United Kingdom and the M.Sc Electrical Power Engineering from University Malaysia Perlis, Malaysia in 2013 and 2015, respectively. Currently, he is working toward his PhD in Electrical and Electronic Engineering at Griffith University, Australia. His main research interests are renewable resources and energy storage system integration and control, microgrid energy management system, forecasting of PV output power and electrical load.