Energy Safety and Control Lab

Short Course on

Design and Implementation of Resilient and High Performance Interconnected Micro Energy Grids

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Speaker: Dr. Hossam A.Gabbar

Dr. Hossam Gaber, is a Professor in the Faculty of Energy Systems and Nuclear Science, and the Faculty of Engineering and Applied Science (cross-appointed) at the University of Ontario Institute of Technology (UOIT), and the Director of the Energy Safety & Control Lab at UOIT. He is a world-leading scholar in the fields of smart energy grid engineering and process systems engineering, with focus on plasma engineering, micro energy grids, and energy safety and control. He is certified TUV Functional Safety Engineer, Fellow RAMSP and Senior Member of IEEE. He is the founding Chair of Toronto Chapter of the IEEE Nuclear & Plasma Science Society, and the founding Chair of the Technical Committee on Intelligent Green Production Systems at IEEE, Systems, Man, & Cybernetics Society. Dr. Gaber is the chair and co-founder of the Symposium on Plasma and Nuclear Systems, and the founder of the IEEE International Conference on Smart Energy Grid Engineering. He serves as the Editor-in-Chief of the International Journal of Process Systems Engineering. He also founded the Reliability, Availability, Maintainability, and Safety Professionals (RAMSP) Society, and currently serves as its VP, Safety. Dr. Gaber has successfully managed the completion of 57 theses, has more than 212 academic journal publications to his name, holds several inventions/patents, has published several books, and is regularly invited as a speaker at international symposiums and conferences. His previous successfully completed projects include Modeling & Simulation of Green Hybrid Energy Production / Supply Chains With Grid Integration, Automated Control Recipe Design for Flexible Chemical Batch Production Plants, Biomass Production Chain Planning, and Plastic Production Chain with Recycling.

Short Description

This course will provide foundations of the design of resilient micro energy grids, and their implementations on different applications. Participants will acquire knowledge about control system design of resilient micro energy grids and performance optimization to meet different operating conditions. To achieve resiliency, attendees will practice fundamentals of risk management, safety design, protection layers, and reliability assessment of safety protection layers, including distributed energy resources, gas-power technologies, energy storage, distributed generation, and other independent protection layers. Attendees will discuss hazard scenarios related to micro energy grids. Modeling and simulation environment will be utilized to evaluate different design and control alternatives from planning to scheduling activities. Engineering foundations will be discussed to enable participants to design and validate resilient micro energy grids with different key performance indicators. Attendees will practice micro energy grid management tools to support the integration of resilient interconnected micro energy grids in different disciplines such as hotels, hospitals, transportation, residential buildings and home clusters.

Who Should Attend?

- Academia:
  - Researchers in the areas of electrical, energy, transportation systems
- Industry:
  - Energy systems engineers
  - Energy managers in facilities and factories
  - Utilities, power generation, energy suppliers / trade
  - Energy technology providers, energy automation, control, protection
  - Energy systems designers, planners
  - Maintenance companies of energy facilities and infrastructures
- Government / Regulators / Energy Licensers

Why to Attend?

- Understand foundations of MEG for integrating DER in distribution and energy networks
- Understand foundations of ESN-Energy Semantic Network and their use to plan interconnected MEGs
- Analyze risks of integrating DER, DG, gas-power technologies within MEG
- Practice risk management framework and hazard scenarios in energy networks
- Understand safety and protection layers for resilient interconnected MEG
- Evaluate fault propagation and monitor safety performance indicators for effective MEG management
- Practice MEG applications on transportation, water networks, residential and industrial facilities

Agenda: Day-1: 9am – 5pm

- Opening
- Introduction to Smart Energy Grids
- Micro Energy Grid (MEG) Planning
- Gas-Power Grids and Technologies
- CHP Integration
- Renewable Energy Integration
- Interconnected MEG Design, Operation
- Control Strategies of MEG and Interconnected MEGs
- Intelligent Control Systems and System Architecture
- Performance Optimization of Interconnected MEGs
- MEG Implementations in Buildings, Infrastructures and Transportation
- Case Studies and Discussions

Agenda: Day-2: 9am – 5pm

- Resilient MEGs
- Risk Management for Energy Grid Infrastructures
- Hazard and Risk Analysis Techniques
- Safety Design and Protection Layers
- Fault Tolerant Control Systems
- Self-Healing Mechanisms
- Real Time Safety Verification
- Case Studies and Discussions
- Exam and Certification
- Closing