Energy Safety and Control Lab

Hossam A.Gabbar, PhD, P.Eng., FS Eng (TÜV Rheinland), CEM, Fellow RAMSP

Professor, Director of Energy Safety and Control Lab, Faculty of Energy Systems and Nuclear Science, and Faculty of Engineering and Applied Science (Cross-Appointed), University of Ontario Institute of Technology, Canada

Flywheel Energy Storage Platform for Resilient Transportation and Transit Systems

The talk will cover detailed solution of Flywheel Energy Storage Platform (FESP) for transportation / transit, including buses and railways. FESP will have integrated schemes and technologies to ensure optimum and high efficient energy system. FESP includes flywheel energy storage system, which is one of the most promising technologies for replacing conventional lead acid batteries as energy storage systems for a variety of applications, including automobiles, economical rural electrification systems, and standalone remote power units commonly used in the telecommunications industry.
FESP can be applied as alternative technology for currently installed batteries, or to be integrated with them as a hybrid energy storage system to achieve optimum performance. FESP will be integrated with advanced dynamic control scheme to enhance the performance and storage capabilities of the flywheel, reduce the charging time, and to increase the operating life time. A key feature of the proposed solution is to provide a replacement energy storage module at charging stations to reduce the charging waiting time in some cases as well as to achieve optimal operating costs. This requires control action to optimize the decision to charge or replace at each station.

In order to achieve global management and optimization of the bus (or transit) systems, an integrated Bus Energy Management System (BEMS) is proposed to the following functions: (a) monitor and control the FESP in each bus during the trips; (b) monitor and control the charging of FESP at the charging stations; and (c) monitor and control the replacement of energy storage module at the charging station. These decisions will be based on economic and technical optimization criteria. This talk will explain best practices and practical ways of implementation of the FESP in worldwide transportation / transit applications.

About the Speaker

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 Functional Safety Engineer (TÜV Rheinland), 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.


AQUAFINA