Microgrid Protection: Heading off Its Complexities

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Keynote Speaker

Short Biography

Assoc. Prof. Ts. Ir. Dr. Mohammad Lutfi Othman is an Associate Professor of Electrical Power Engineering at the Universiti Putra Malaysia. He holds a BSc in Electrical Engineering from University of Arizona, MS and PhD in Electrical Power Engineering from the Universiti Putra Malaysia. He is a researcher and the founding member of the Centre for Advanced Power and Energy Research (CAPER), now consolidated as Advanced Lightning, Power and Energy Research (ALPER). He also practices as an Electrical Engineering Consultant in electrical services installation works by diversifying as an Electrical Director/Partner in a local engineering consulting firm. He has 31 years of professional industrial experience of over 250 construction projects in design, tendering, contracting and project administration of electrical works consultancies. His specific research interests are in power system protection (protective relay operation modelling and analysis, computational-intelligence-based data mining for knowledge discovery in relay database, application of artificial intelligence in protection algorithms, adaptive numerical protective relays, development of numerical protective relays), power system operation (power quality, smart grid, microgrid, distributed generation), electrical services installation works (design, project administration consultancy), energy efficiency management (demand side management, building energy management system) and project management. He has supervised over 59 graduate students as a main- and co-supervisor (of which 40 are PhDs). He has been funded for 20 research projects from government and industry, as principal and co-researcher. He is an author of numerous manuscripts of high impact factor journals, other SCOPUS indexed journals and conference proceedings, totalling 120 journal papers, 5 chapters in books and 90 conference proceedings. He is an Academic Editor and a Reviewer of various manuscripts submitted for journal and conference proceeding publications and a technical evaluator of university and government research grant applications. He has been a keynote and invited speaker and a session chair of various international conferences. He is a Professional Engineer with Practicing Certification (PEPC) registered under the Board of Engineers Malaysia (BEM), an ASEAN Chartered Professional Engineer (ACPE), a Chartered Engineer (CEng) registered under the Engineering Council UK, a Professional Technologist (PTech) registered under the Malaysian Board of Technologists, a Registered Electrical Energy Manager (REEM) under Energy Commission Malaysia, a Certified Professional in Measurement and Verification (CPMV) under Malaysian Green Technology Corporation (Ministry of Environment and Water, Malaysia (KASA)), a Corporate Member of the Institution of Engineers Malaysia (IEM), a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE) USA, a Senior Member of the IEEE Power and Energy Society (IEEE-PES), a Senior Member of the IEEE Computational Intelligence Society (IEEE-CIS), a member of the Institution of Engineering and Technology

(IET) UK, a member of the International Rough Set Society (IRSS), a member of the Asian Council of Science Editors (ACSE), a member of the AcademicKeys Who's Who in Engineering Higher Education (WWEHE), and a member of Phi Kappa Phi Honor Society, The University of Arizona. His biographical profile is mentioned in the Marquis Who's Who in the World 2016 (33rd Edition). As a Professional Engineer, he is a Mentor and Professional Interviewer for IEM/BEM Professional Engineer as well as the Engineering Council UK Chartered Engineer aspirants. He is an Engineering Accreditation Council (EAC) panel member under BEM for university engineering program accreditation.

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Abstract

Microgrid has been evolving the world over for the past twenty years at a tremendous speed. It is composed of an integrated set of power-producing and power-consuming resources. A microgrid is capable to run either independently of the regional power system (island mode) or synchronously with the power system (connected mode), and seamless transition between the two modes. As the prevalence and complexity of microgrids with significant levels of inverter-based resources (IBRs) (renewable and distributed), energy storage, and managed loads grow tremendously, microgrid protection has drawn a serious attention. Operating in parallel with the grid and offering grid support services, their impact on the grid reliability has led to a serious consideration for utility system protection schemes. Unless protection is taken into consideration, microgrids may not lead to appreciable reliability and resiliency. Microgrid protection is a critical issue to lead up to achieving safe, efficient, and effective means of managing this emerging complex system. The combination of highly penetrating distributed energy resources (DERs) via power electronic interfaces and their disengagement from the larger distribution grid in islanded operation are the challenges faced by microgrid protection design that significantly departs from conventional power system protection philosophy in grid-connected mode. When microgrids transition from grid-connected to autonomously islanded modes of operation, the protection schemes must be changed through protection system settings or made as adaptive protection systems. Such accommodating protection systems must consider microgrids having to aggregate local DERs, which include renewable energy resources (wind and solar), and the associated electrical storage required for harmonising and firming intermittent generation. The presence of the power electronic-based DERs interconnected to the distribution grid warrants protection approaches that are complex and distinctive from those for conventional rotating-machine-based DERs, such as combined heat and power, diesel or small hydroelectric generators. The major challenges in devising a robust protection plan include limited fault-current capacity of the inverters, bidirectional and variable fault currents, the disparate design considerations of the DER controllers and the need of coordination of communication schemes. These complexities and specific protection requirements are unique to microgrid systems, in both connected and islanded operating modes as well as the transition between them.