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Georgia Southern University

Dr. Masoud Davari, Electrical and Computer Engineering Assistant Professor in the area of Power, Presents in Research Colloquium

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Dr. Masoud Davari, Electrical and Computer Engineering Assistant Professor in the area of Power, presented his research during the Department's Research Colloquium held February 9, 2018.

Dr. Masoud Davari, Assistant Professor, Electrical and Computer Engineering

Integrated Power and Energy Systems for Advanced Smart-Grids Technologies

Abstract—Modernized microgrid (MMG) is the essential section of the energy sector and the power industry under the umbrella of smart grids. MMG closely mimics the terrestrial power system but it has its own unique characteristics (including variable frequency; power-sharing vs power scheduling; lack of time-scale separation; short electrical distances; and tighter controls) which must be effectively addressed. In this research colloquium, the fully integrated power and energy system (FIPES) concept will be introduced and investigated as a new trend in the MMG integration. The FIPES-based MMGs will be able to supply demanding and high-power loads at smaller number of prime movers; more flexibility in the arrangements; improved reliability; better power quality; more convenience in renewable distributed energy resource (DER) integration; and increased number of integrated energy storage system (ESS) units to benefit from their dynamic response and/or energy arbitrage. They will be able to achieve the power system design and performance goals at a lower hardware capacity; lower ESS requirements; hybrid ac/dc structure; and more sophisticated power electronic converters based on fast switching technologies, simultaneously resulting in high frequency, high power, and high power-density. In this regard, development of advanced control and protection systems for FIPES-based MMGs is the most urgent task. This is a challenging task due to the architectural aspects and components diversity and due to the characteristics specified above. This research colloquium will address those aspects, robust and advanced controls, and protection systems for FIPES-based MMGs. Issues such as integrating strong coupling dynamics; extending to large frequency-variable conditions; tolerating critical system and sensor faults; augmenting system robustness with cybersecurity aspects; developing nonlinear and strong controls; and enhancing hardware-in-the-loop (HIL) digital simulations will be considered and addressed.