



CONVENTIONAL AND EMERGING UNCONVENTIONAL POWER SYSTEMS: CHALLENGES AND OPPORTUNITIES

~ by ~

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OVERVIEW

The power system has undergone significant changes and improvements. One of the most important ongoing revolutions is the emergence of wide bandgap (WBG) semiconductors. WBG-based power electronics (PEs) will play a key role in connecting distributed energy resources and DC loads to power grids and for power control. The Achilles heel of this ongoing and future technology is accelerated aging of the insulation systems used in all electrification components due to exposure to the high slew rates and repetitive voltage pulses that originate from WBG-based PEs; discussed in this seminar. This issue is more important in the emerging unconventional power systems in all-electric ships and aircraft where intelligent online condition assessment of electrical insulation is highly needed. Another challenge is that, despite significant changes in supply and demand, transmission lines have retained their traditional designs. These designs are currently, and will continue to be, major bottlenecks within power systems where grid loadability is determined by their operational limitations. I will present my work on (i) revolutionary and flexible designs for transmission lines, which are achieved by shifting phase configurations and sub-conductors into unconventional arrangements that are geometrically optimized within the space, and (ii) the creation and introduction of a novel transmission expansion planning (TEP) framework, where line parameters that do not play a role in traditional TEP will now play key roles as variables in this new framework. Resiliency is and will also continue to be the most concern of the US power system. To restore critical loads, I will present an optimal planning-operation concept that benefits from both (i) microgrid planning and (ii) various operation-based actions that enhance resiliency.

BIO

Mona Ghassemi (Senior Member, IEEE) received M.Sc. (2007) and Ph.D. degrees (Hons.) (2012) in electrical engineering from the University of Tehran, Tehran, Iran.

From 2013 to 2015, she was a Post-Doctoral Fellow with the High Voltage Laboratory of NSERC/Hydro-Quebec/UQAC, an Industrial Chair on Atmospheric Icing of Power Network Equipment, and the Canada Research Chair on Power Network Atmospheric Icing Engineering, University of Quebec, Chicoutimi, QC, Canada. She was also a Post-Doctoral Fellow with the Electrical Insulation Research Center, Institute of Materials Science, University of Conn, Storrs, CT, USA, from 2015 to 2017. In 2017, she joined the Department of Electrical and Computer Engineering, Virginia Tech, Blacksburg, VA, as an Assistant Professor, and



in 2021, she was appointed as both the Steven O. Lane Junior Faculty Fellow and the College of Engineering Faculty Fellow. She has been a registered Professional Engineer in the Province of Ontario, Canada, since 2015. Her research interests include electrical insulation materials and systems, high-voltage/field technology, Multiphysics modeling, electromagnetic transients in power systems, and power system analysis and modeling.

Dr. Ghassemi is an At-Large Member of the Administrative Committee of the IEEE Dielectrics and Electrical Insulation Society from 2020 to 2023, a Corresponding Member of the IEEE Conference Publication Committee of the IEEE Power and Energy Society, an Active Member of several CIGRE working groups and IEEE Task Forces, and a Member of the Education Committee of the IEEE DEIS and PES. She was a recipient of the 2020 Contribution Award from the High Voltage journal, the 2020 National Science Foundation (NSF) CAREER Award, the 2020 Air Force Office of Scientific Research (AFOSR) Young Investigator Research Program (YIP) Award, and the 2021 Department of Energy Early Career Research Program Award. She is an Associate Editor of the IEEE Transactions on Dielectrics and Electrical Insulation, the IEEE Transactions on Industry Applications, High Voltage, the International Journal of Electrical Engineering Education, and Power Electronic Devices and Components (Elsevier), and a Guest Editor for Energies.
