

Design and Simulation Issues for Secure Power Networks as Resilient Smart Grid Infrastructures

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Abstract: The increased penetration levels of renewables and distributed energy resources lead to increased challenges in maintaining reliable control and operation of the grid. Integrating a wide variety of systems governed by different regulations and owned by different entities to the grid increases the level of uncertainty not only on the demand side but also in terms of generation resource availability. This complicates the process of achieving generation versus demand balance. Renewable energy sources vary by nature and require intelligent forecasting and prediction systems to determine how and when this energy can be used. Controlling distributed resources that owned by customers which have enough capacity to support the grid during peak hours and provide ancillary service, is another challenge. Most of these distributed resources will be installed on the distribution network, which already in its current state, lacks the proper communication and control network necessary to control the applicable resources. Moreover, the large number and widespread use of these resources makes them difficult to control from a central location.

To overcome these problems, deep integration between intelligent measurement nodes, communication systems, IT technology, artificial intelligence, power electronics and physical power system components will be implemented to manage the modern smart grid resources. On one hand, this type of integration can dramatically improve grid performance and efficiency, but on the other, it can also introduce new types of vulnerability. The risk of vulnerability escalates when the level of integration between physical and cyber components of the power system increases. The design and optimization of such complex systems requires coordination between the cyber and physical components in order to obtain the best performance while minimizing the risk of vulnerability. In other words, the physical power system must be designed as a security-aware system.

Biographical Sketch of Professor Osama A. Mohammed

Dr. Mohammed is a Professor of Electrical Engineering and is the Director of the Energy Systems Research Laboratory at Florida International University, Miami, Florida. He received his Master and Doctoral degrees in Electrical Engineering from Virginia Tech in 1981 and 1983, respectively. He has performed research on various topics in power and energy systems in addition to computational electromagnetics and design optimization in electric machines, electric drive systems and other low frequency environments. He performed multiple research projects for several Federal agencies since 1990's dealing with; power system analysis, physics based modeling, electromagnetic signature, sensorless control, electric machinery, high frequency switching, electromagnetic Interference and ship power systems modeling and analysis. Professor Mohammed has currently active research programs in a number of these areas funded by DoD, the US Department of Energy and several industries.



Professor Mohammed is a world renowned leader in electrical energy systems and computational electromagnetics. He has published more than 400 articles in refereed journals and other IEEE refereed International conference records. He also authored a book and several book chapters. Professor Mohammed is an elected Fellow of IEEE and is an elected Fellow of the Applied Computational Electromagnetic Society. Professor Mohammed is the recipient of the prestigious IEEE Power and Energy Society Cyril Veinott electromechanical energy conversion award and the 2012 outstanding research award from Florida International University.

Professor Mohammed has lectured extensively with invited and plenary talks at major research and industrial organizations worldwide. He serves as editor of several IEEE Transactions including the IEEE Transactions on Energy Conversion, the IEEE Transactions on Smart Grid, IEEE Transactions on Magnetics, COMPEL and the IEEE Power Engineering Letters. Professor Mohammed served as the International Steering Committee Chair for the IEEE International Electric Machines and Drives Conference (IEMDC) and the IEEE Biannual Conference on Electromagnetic Field Computation (CEFC). Professor Mohammed was the General Chair of the 2009 IEEE IEMDC conference held in Miami Florida, May 3-6 2009 and was the Editorial Board Chairman for the IEEE CEFC2010 held in Chicago, IL USA, May 9-12, 2010. Professor Mohammed was also the general chair of the IEEE CEFC 2006 held in Miami, Florida, April 30 – May 3, 2006. He was also general chair of the 19th annual Conference of the Applied Computational Electromagnetic Society ACES-2006 held in Miami, Florida March 14-17, 2006. He was the General Chairman of the 1993 COMPUMAG International Conference and was also the General Chairman of the 1996 IEEE International Conference on Intelligent Systems Applications to Power Systems (ISAP'96) Dr. Mohammed has chaired the Electric Machinery Committee for IEEE PES was the Vice Chair and Technical Committee Program Chair for the IEEE PES Electric Machinery Committee for a number of years. He was a member of the IEEE/Power Engineering Society Governing Board (1992-1996) and was the Chairman of the IEEE Power Engineering Society Constitution and Bylaws committee. He also serves as chairman, officer or as an active member on several IEEE PES committees, sub-committees and technical working groups.

For complete list of publications and the Smart Grid Test Bed, the following link has all the details;
<http://www.energy.fiu.edu>