

Electric Power and Power Electronics Institute

WEEKLY SEMINAR SERIES – FALL 2017

Thursday, September 21st, 2017, 1:00 – 2:00 p.m., WERC 236C

USE OF ENERGY STORAGE FOR RELIABILITY IMPROVEMENT OF RENEWABLE GENERATION

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Abstract

Increasing penetration of renewable resources in the grid pose several challenges to reliable operation. Utilities have begun deploying energy storage technologies as a means of mitigating some of these challenges. Although the presence of energy storage ameliorates the reliability challenges posed by intermittent sources, a quantitative assessment of the exact amount of storage required to meet a reliability target or guarantee in the presence of intermittent sources is not trivial. This presentation examines some of the challenges posed by renewable generation and means of quantifying their impacts on grid reliability, and discusses approaches to mitigate them using energy storage. Applications to three types of systems – standalone, island-capable, and interconnected – are presented.

The presentation systematically develops a mathematical method for determining the amount of storage required to meet a reliability target at a specific load point, and extends it to a more complex island-capable microgrid system with solar generation, and a grid-connected system with wind generation. It discusses reliability metrics and targets, and a method for quantifying the notion of "firming" up an intermittent resource. Effects of resource availability and network constraints are considered. The presentation concludes with a discussion of another characteristic of renewable resources – low inertia – and how it impacts system reliability, and of ongoing research toward developing solutions for mitigating these impacts.

Biography

Joydeep Mitra is Associate Professor of Electrical Engineering at Michigan State University, East Lansing, Director of the Energy Reliability & Security (ERiSe) Laboratory, and Senior Faculty Associate at the Institute of Public Utilities. He received a Ph.D. in Electrical Engineering from Texas A&M University, College Station, and a B.Tech.(Hons.) in Electrical Engineering from Indian Institute of Technology, Kharagpur. He has five years of industry and consulting experience ranging from power system hardware installation to modeling and simulation of energy markets, and seventeen years of academic experience. Prof. Mitra has conducted research in power system modeling, analysis, stability, control, planning and simulation, and is known for his contributions to power system reliability analysis and reliability-based planning. He has over 170 publications and patents in the power systems area, including an edited book, an IEEE Standard, book chapters, technical articles and research reports. Prof. Mitra's research has been funded by the U.S. National Science Foundation, the U.S. Department of Energy, U.S. National Laboratories, and several electric utilities. Prof. Mitra is a Senior Member of the IEEE. He serves as an Editor for the IEEE Transactions on Power Systems and Power Engineering Letters. In the past he has served as Chair of the IEEE-PES Analytic Methods for Power Systems Committee, Chair of several IEEE-PES Subcommittees, and as an Editor for the IEEE Transactions on Smart Grid. Prof. Mitra engages actively in several IEEE activities such as organizing conference tracks and contributing to the development of IEEE standards.