

Title: Construction of Self-Healing Smart Grids

Speaker:

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Venue: Room 603, Chow Yei Ching Building

Abstract:

Recent interest in the establishment of smart power grids is driven by the requirements for a more reliable, economic and environmentally friendly energy infrastructure. Self-heal is one of the most desirable features of the smart grid. It is the immune system of the smart grid. A self-healing smart grid can minimize the disruption of energy services and promises a reliable, resilient and responsive electric supply through online self-assessment, real-time risk analysis, and online strategy establishment,. However, few, if any, systematic methodology for establishment of self-healing smart grids is available at present. With significant renewable resources and responsive loads being introduced, the variability and uncertainty on both generation side and demand side significantly aggravate the challenges.

This research addresses the development of a systematic methodology for establishment and evaluation of self-healing strategies in the context of smart grids. For the purpose of automatically anticipates and responds to disturbances, three major aspects are covered in the proposed approach. A comprehensive self-healing methodology associated with high-efficient algorithms to respond to disturbances is proposed first. A novel system restoration philosophy, called target-oriented methodology, is proposed. By this philosophy, a uniform framework, which fully accommodates different components of smart grids, is developed as the essential component of self-healing smart grids. Secondly, to anticipate disturbances and monitor self-healing processes, a set of sophisticated methods are proposed to integrate the state-of-the-art information acquisition technology. These methods

ensure complete observability of each self-healing stage with data taken from phasor measurement units (PMUs). Finally, to fully assess the risk of a self-healing strategy for a system with high percentage stochastic renewable energy resources and responsive loads, a novel scenario reduction algorithm associated with a set of coherent risk measures is proposed. Using this algorithm, the risk of a self-healing strategy can be assessed with reduced stochastic scenario analyses. It is believed that the proposed methodology is the major step to implement self-healing smart grids.

Biography of the speaker:

Dr. Yunhe Hou received his B.E. (1999) and Ph.D. (2005) degrees from Huazhong University of Science and Technology, China and worked as a postdoctoral research fellow at Tsinghua University, China, from September 2005 to August 2007. In 2008, he worked as a postdoctoral researcher at Iowa State University, U.S.A, and then a research scientist with University College Dublin, National University of Ireland, Dublin, Ireland in 2009. From September 2010 to January 2011, he was a visiting scientist with Laboratory of Information and Decision Systems (LIDS) of Massachusetts Institute of Technology (MIT). He has been a Research Assistant Professor with Department of Electrical and Electronic Engineering, the University of Hong Kong, since July 2009. Recently Dr. Hou has been commissioned by several research institutes, including Electric Power Research Institute (USA), and Chinese Academy of Sciences, to conduct research on theory and implementation of self-healing smart grids.