Wind Power Ramps Data Analytics, Probabilistic Modeling and Risk Assessment

Abstract:

Wind power has been integrated into bulk power systems of the U.S. at a rapidly increasing amount. In particular, grid-connected wind power capacity in ERCOT has increased from 2 GW in 2006 to 16 GW by 2015. While being 'green' and 'free', wind power generation has posed significant challenges for power system operations. Unlike conventional energy resources, wind power generation is intermittent and non-dispatchable, making wind power a source of tremendous uncertainty and risk to power system operations. This presentation will address risk quantification and awareness of large wind power ramps using data analytics methods. First, by using ERCOT historical hourly wind power ramp data, extreme value theory is applied to model the tail distribution of large wind power ramps, based on which typical risk measures, including α% quantile value at risk and conditional value at risk, are computed. Further, real-time mesoscale data collected from the vicinity of wind farms will be utilized for the detection of pertinent weather events, and for the issuance of early alarms to power system operators to arm adequate ancillary services for impending extreme wind power ramps.

Bio:

Dr. Miao He received his B.E. degree from Nanjing Univ. of Posts and Telecom., China, in 2005, and his M.E. degree from Tsinghua Univ., China, in 2008, and his Ph.D. degree from Arizona State University in 2013. He is currently an Assistant Professor at the Department of Electrical and Computer Engineering of Texas Tech University. His research is focused on modeling, optimization and data analytics for smart grid applications.