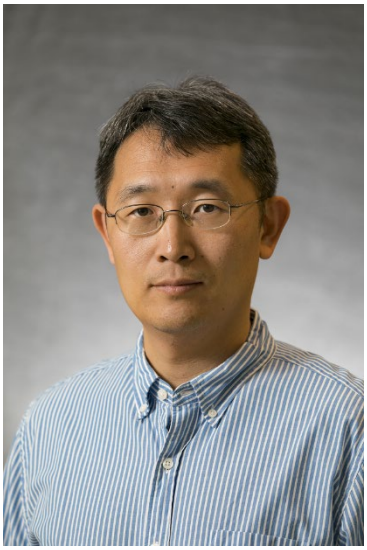
ELECTRICAL AND COMPUTER ENGINEERING SEMINAR



Kai Sun
University of Tennessee

A More Resilient Power Grid with Faster-Than-Real-Time Stability

Thursday, February 27th

DANA 442

11:00am- 12:00pm

Abstract: Since the northeast blackout of 1965, cascading blackouts have continued to happen on power grids in the North America and other countries. For a grid operator, it is vitally important to be aware of real-time stability and reliability margin for the current grid state under possible disturbances. However, a real-world power grid is an extremely complex, nonlinear network system. For instance, the bulk electric system of a US power grid is typically modeled by nonlinear DAEs on 5,000+ electric machines and 50,000+ nodes. Fast stability analysis and simulation of such a large-scale dynamical system subject even to a single disturbance is quite challenging. In the next decade, renewable generation, such as power electronics-interfaced distributed energy resources, will reach 30%-50% in power grids of many countries. That can further increase the complexity of a power grid, change its dynamic characteristics and bring more uncertainties and challenges to real-time grid operations. For a more resilient grid, the power industry is looking forward to emerging technologies that enable "faster-than-real-time" stability assessment and adaptive, distributed control to prevent and mitigate cascading power outages. The speaker will share his visions and research in this field and introduce two promising enabling approaches established with ongoing supports from NSF and DOE: 1) faster-than-real-time grid simulation using a semi-analytical approach, and 2) grid stability assessment and control based on a new method named "Nonlinear Modal Decoupling" and the utilization of wide-area measurements and distributed energy resources.

Bio:

Kai Sun is an associate professor with the Department of Electrical Engineering and Computer Science in the University of Tennessee, Knoxville. He is also a faculty member with the NSF/DOE Engineering Research Center for Ultra-Wide-Area-Resilient Electric Energy Transmission Networks (CURENT). He received his Bachelor's degree in automation in 1999 and his Ph.D. degree in control science and engineering in 2004 both from Tsinghua University, Beijing. He received the National Top 100 Doctoral Dissertations Award in 2006 from the Ministry of Education of China. Before joining the University of Tennessee, Dr. Sun was a project manager with the Electric Power Research Institute (EPRI) from 2007 to 2012 for R&D programs in the area of grid operations, planning and renewable integration. Earlier, he worked as a research associate at Arizona State University, Tempe.

Dr. Sun received EPRI Chauncey Award, the institute's highest honor, in 2009, two best papers awards from IEEE Power & Energy Society General Meetings in 2014 and 2015, NSF CAREER Award in 2016, the "Most Valuable Players" Award by North American Synchrophasor Initiative and DOE in 2016, and the Professional Promise in Research Award twice in 2016 and 2019 by the College of Engineering, the University of Tennessee. Dr. Sun authored one book titled Power System Control under Cascading Failures and 70+ journal publications. He is currently an associate editor with four IEEE journals including IEEE Transactions on Power Systems, IEEE Transactions on Smart Grid, IEEE Access and IEEE Open Access Journal of Power and Energy.