



TEXAS A&M UNIVERSITY

Department of Electrical
& Computer Engineering

Monday, July 25, 2022 | 12:00 – 1:00 p.m. Central

Meeting Location: WEB 236C

Adaptive State Estimation and Cyber Attack Detection under Unknown and Time-Varying Measurement Error Statistics

Abstract

State estimation (SE) is a core application supporting the situational awareness of power systems. Successful estimator design requires accurate knowledge about measurement error statistics, which are usually unknown and time-varying in reality. Traditional SE algorithms are based on heuristic measurement error assumptions yielding suboptimal error filtering performances. This talk will present a new SE paradigm based on the concept of adaptive estimation. Instead of ignoring or passively resisting the unknown error statistics, it proactively tracks this information and adapts the estimator online to maximize SE accuracy. This technique also enables remote calibration of both PMUs and SCADA meters without the need of field experiments. The talk will also present a simple yet highly discriminative detection method for false data injection attacks (FDIAs) against SE. As real-world FDIAs are always imperfect, they will induce unnoticeable mismatches between measurements and the grid model, reshaping measurement residual distributions outputted by SE. This nuance can be picked up by careful design of hypothesis testing. A unique strength of this approach is effective discrimination between FDIAs and actual grid events, as grid events do not create such mismatches or change measurement residual distributions. Case study results will be presented to demonstrate the superiority of the proposed methods over existing ones.

Yuzhang Lin

Assistant Professor



Dr. Yuzhang Lin is an Assistant Professor in the Department of Electrical and Computer Engineering at the University of Massachusetts Lowell. He obtained his B.Eng. and M.S. degrees in Electrical Engineering from Tsinghua University, Beijing, China, and his Ph.D. degree in Electrical Engineering from Northeastern University, Boston, MA, where he received the Graduate Student Outstanding Research Award. His research interests focus on smart grid and renewable energy, especially in the aspects of modeling, situational awareness, cyber-physical resilience, and machine learning applications. His research is funded by National Science Foundation (NSF), U.S. Department of Energy (DOE), and Office of Naval Research (ONR). Dr. Lin is the Co-Chair of the IEEE PES Task Force for Standard Test Cases for Power Systems State Estimation. He also serves as an Associate Editor for IET Generation, Transmission & Distribution Journal and a Subject Editor for CSEE Journal of Power and Energy Systems. He is a recipient of NSF CAREER Award.