

Title: Robust Unscented Kalman Filter for Power System Dynamic State Estimation using PMUs

Speaker: Lamine Mili Department of Electrical and Computer Engineering Virginia Tech, Northern Virginia Center Falls Church, VA 22043, USA

In this talk, we present a new theoretical framework that, by integrating robust statistics and robust control theory, allows us to develop a robust dynamic state estimator of a power system. This state estimator combines the generalized maximum-likelihood-type (GM)-estimator, the unscented Kalman filter, and the H-infinity filter into a robust H-infinity-UKF filter in the Krein space, which is able to handle large system uncertainties as well as suppress outliers while achieving a good statistical efficiency under Gaussian and non-Gaussian process and observation noises. Specifically, the statistical linearization approach is first applied to build a linear-like regression model in the Krein space. Then, the GM-estimator is combined with the H-infinity criterion to develop a new filter that is able to handle both outliers and uncertainties in the model. The good performance of the new filter is demonstrated on the IEEE 39-bus system.

Bio: Lamine Mili is a fellow of the IEEE and a professor of Electrical Engineering at Virginia Tech. He received the Electrical Engineering Diploma from the Swiss Federal Institute of Technology, Lausanne, Switzerland, in 1976, and the Ph.D. degree from the University of Liège, Liège, Belgium, in 1987. He is a Professor of electrical and computer engineering with Virginia Tech, Blacksburg, VA, USA. He has five years of industrial experience with the Tunisian electric utility, STEG. At STEG, he worked in the planning department from 1976 to 1979 and then at the Test and Meter Laboratory from 1979 to 1981. He was a Visiting Professor with the Swiss Federal Institute of Technology in Lausanne, the Grenoble Institute of Technology, the École Supérieure D'électricité in France and the École Polytechnique de Tunisie in Tunisia, and did consulting work for the French Power Transmission company, RTE. His research has focused on power system planning for enhanced resiliency and sustainability, risk management of complex systems to catastrophic failures, robust estimation and control, nonlinear dynamics, and bifurcation theory. He is the Co-Founder and Co-Editor for the International Journal of Critical Infrastructure. He is the Chairman of the IEEE Working Group on State Estimation Algorithms. He is a recipient of several awards including the U.S. National Science Foundation (NSF) Research Initiation Award and the NSF Young Investigation Award.