Electric Power and Power Electronics Institute

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PMU Applications in System Integrity Protection Scheme

Xiaochen Du, PhD

Smart Grid Center, ECE Department

Abstract
Electric power systems are now becoming increasingly stressed and complex as a result of evolving demands for efficiency and reliability. In addition, because of environmental and economic constraints, it is difficult to build new transmission links. In recent years, large area blackouts occurred in many countries caused by cascading failures, resulting from technical mal-operations and inappropriate human responses. Such scenarios are unacceptable and consequently appropriate control measures need to be taken to bring the system back to its normal state, without deteriorating the quality of supply. A robust System Integrity Protection Schemes (SIPS) enables a system to be operated near to its stability limit without compromising security. This talk will present two types of real time SIPS aiming to resolve the transient stability problems in power systems.

1) The E-SIME (emergency single machine equivalent) based SIPS: the SIME approach is used to evaluate the transient stability of the system and then a decision is made about the control actions needed to stabilize the system. During emergency conditions, a fast response time is very important and this requires a security guideline to be used in the decision making process. The guideline is developed by analyzing offline multiple fault scenarios using a supervised learning approach. This ensures appropriate control actions that can be performed without compromising the response time required on a real system.

2) The MPC (model predictive control) based SIPS: it optimizes the control action at every discrete time instant by selecting the control action that leads to the minimized cost function value. A machine learning algorithm is utilized to predict power system dynamics by assuming each control action has been taken. Furthermore, a feature selection technique, that chooses the most relevant variables, is used to improve the performance of the system trajectory prediction. The MPC technique is performed every discrete time interval, so the optimal control action is always selected.

Biography
Dr. Xiaochen Du is a Postdoctoral Research Associate in the Smart Grid Center under Dr. Mladen Kezunovic's supervision at ECE Dept., Texas A&M University. She received her Ph.D. degree from University of Manchester, UK. After years of working in National Grid Research Center in UK, she joined Texas A&M to develop solutions for smart grid applications. Her main research interests are the wide area monitoring and protection, system integrity protection scheme, transient stability control and risk assessment.