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Particle Filter Joint State and Parameter Estimation of Dynamic Power Systems

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Abstract

Intermittent renewable energy sources in distributed generation will increase the chance of sudden unpredictable changes in the system states and parameters of dynamic power systems. To track the changes of the power systems, system state and parameter estimation methods that can track the near real-time dynamics of the power systems are needed. Power system operators still employ simulation studies using off-line models that are built based on prior knowledge gained through information via simulated typical scenarios which does not make use of posterior knowledge of neither parameter space nor state space of the dynamics of the power systems. Dynamic models of a power system has increasingly more important role in power system operations since they impact the operational conditions of dynamical power system.

In this study, we propose a particle filter based state and parameter estimation method to improve modelling accuracy, which determines the best set of model parameters using realtime measurement data. This can be achieved via measurements by Phasor Measurement Units (PMU) or Remote Terminal Units (RTU) that can capture the system dynamic responses in real time. In addition, parameters of the system can also be estimated. Herein the load will be the parameter of the system that needs to be estimated jointly with the states. Joint state and parameter estimation for power systems via employing Bayesian particle filter is being introduced in this study.

Index Terms

Particle filter, state and parameter estimation, power system modelling, Bayesian Monte Carlo methods