Simplex Optimization for Particle Filter Joint State and Parameter Estimation of Dynamic Power Systems

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Abstract

The incidence of sudden unanticipated variations in power system states and parameters will tend to increase due to higher intermittent renewable energy penetration in distributed generation. It is needed to have proper state and parameter estimation tools that can follow-up these variations and can reflect the real-time system dynamics. In this paper, a particle filter with Nelder-Mead simplex optimization algorithm is implemented to estimate the states and a parameter of a three-node benchmark test model. The performance of Bayesian particle filter for joint estimate of the states and parameter for the benchmark nonlinear power system model has been analysed and favorable results were obtained by minimizing approximated negative loglikelihood function via Nelder-Mead simplex algorithm.

Index Terms

Particle filter; state and parameter estimation; power system modelling; Bayesian Monte Carlo methods; simplex optimization; Nelder-Mead algorithm