Dynamic State Estimation of a Synchronous Generator with Unknown Parameters

Alireza Rouhani and Ali Abur
Northeastern University, Boston

Introduction

- Miscellaneous approaches for the dynamic state estimation of the synchronous machines are proposed so far by various investigators.
- In the majority of the reported studies, it is assumed that the dynamic model of the synchronous machines which are determined by the values of the associated parameters are perfectly known.
- However, in reality this assumption may not be valid due to the possible existence of unknown parameters in the synchronous generator’s dynamic model.
- In this paper, a robust UKF based (CIUKF) dynamic state estimation will be introduced which is capable of providing a highly accurate dynamic state estimation result when it assumes that some of the parameters related to the dynamic model of the synchronous machine are unknown.

Simulation Results

- In this paper constrained UKF based dynamic state estimation approaches are used to perform dynamic state estimation for a synchronous generator with unknown parameters and inputs.
- Under same initialization assumption, UKF, Constrained UKF and Constrained IUKF are used to obtain the dynamic state estimation results for a two-axis model of a synchronous generator where the inertia constant, d-axis synchronous reactance are considered as unknown parameters.
- While the estimated results obtained from UKF for some of the state variables and unknown parameters and inputs diverge from the corresponding true trajectories, the estimated results obtained from Constrained UKF and Constrained IUKF converge to the associated true trajectories.

Conclusions