A Maximum A-Posteriori Based Algorithm for Dynamic Load Model Parameter Estimation

Siming Guo
Department of Electrical and Computer Engineering
University of Illinois at Urbana-Champaign

Abstract
Transient stability analysis is becoming increasingly important for power systems engineers and researchers. Accurate dynamic models are required, but aggregate load models are an area of weakness. Measurement-based system identification methods based on least-square minimization have difficulty determining model parameters because the models do not satisfy injectivity: vastly different model parameters can produce the same output waveform for a given disturbance. One could argue that the parameters of a model are unimportant, as long as the simulation output waveforms are correct. While this is true for the disturbance(s) we used to determine the parameters, we show that the model fails when we try to use it to predict the result of other disturbances. Thus, we must attempt to regain injectivity. In this paper, we present two methods for doing so. First we try using multiple disturbances, but this does not have a significant impact. Second, we present an algorithm based on a maximum a-posteriori (MAP) estimator, which is much more robust than least-squares. The MAP estimator can take advantage of prior knowledge of the parameters of the grid. We show that the MAP-based algorithm is extremely robust to measurement noise, even down to SNRs approaching zero.

Use of Sparse Magnetometer Measurements for Geomagnetically Induced Current Model Validation

Maryam Kazerooni
Department of Electrical and Computer Engineering
University of Illinois at Urbana-Champaign

Abstract
This presentation focuses on interpolating the magnetic field data to improve the model validation for geomagnetically induced currents (GICs). The available magnetic data is very sparse over the Earth's surface and readings of a distant magnetometer are often used for model validation. We propose an interpolation technique that considers the magnetic field inherent characteristics. The real magnetic data over a three-year period is analyzed and the dependencies between the observatories are extracted. These interdependencies are eventually incorporated in the interpolation and higher performance is achieved.