

A Hybrid Approach for Distribution System State Estimation (DSSE)

Objective: Day-ahead multi-phase unbalanced DSSE with bad data and topology change detection

Challenges: High penetration of solar; low measurement redundancy for distribution networks

Approach:

(1) Bad data and topology change detection:

Before estimating the state variables, we will use statistical methods (including machine learning) to detect and identify bad data and topology change. We will train the model to explore the patterns of bad data and topology change on the historical data set. If needed, upon the completion of DSSE, we will cross-validate the solution based on power flow calculation.

(2) Pseudo measurement creation:

For predefined locations for pseudo measurements, we will use statistical methods (including machine learning) to create pseudo measurements. Depending on the types of measurements, we will leverage advanced solar/load forecasting algorithms.

(3) Machine learning assisted weighted least squares for DSSE:

We will minimize the sum of measurement residual squares, weighted by the inverse of the variance of meter errors. Since the underlying problem is highly nonlinear, we will use Newton's method to iteratively find the optimal solution. To facilitate the process, we may use machine learning methods to set the initial points and possibly fix the values of some variables.