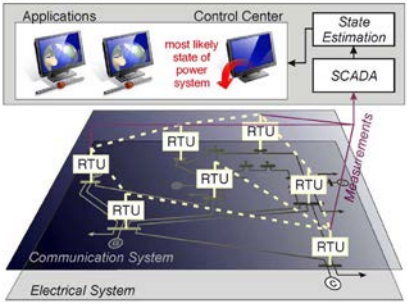
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Power Systems Laboratory

Least Absolute Value State Estimation

Supervisor(s): Dmitry Shchetinin
(shchetinin@eeh.ee.ethz.ch, ETL G24.2,
Phone: 044 632 74 75)
Type: MA (Theory/Design)

Description



State estimation is indispensable for modern power systems. Both online security analysis and actions of system operators rely on the results provided by state estimation (SE). Currently, most widely used algorithms for obtaining a system state are based on the Weighted Least Squares (WLS) method, which is not robust to bad input data such as incorrect measurements. Detecting and eliminating bad measurements in WLS-based approaches is a complicated and time-consuming process. Therefore, there is a need for new SE methods that are more robust to outliers in input data and require fewer tuning parameters than conventional algorithms.

Goals and Objectives

The main objective of this thesis is to develop, implement and test an SE algorithm based on a Least Absolute Value (LAV) measure of errors. The usage of absolute values of errors instead of their squares helps reduce the impact that incorrect measurements have on the accuracy of the solution.

The SE problem should be formulated as a weighted LAV problem using the nonlinear steady-state model of a power system. The problem should be cast as a smooth nonlinear optimization problem so that it is solvable by various gradient-based methods. The developed algorithm should be compared with the traditional WLS-based algorithms and LAV-based non-smooth algorithms in terms of the bad data handling and computational efficiency. The comparison should be done using several test systems of various sizes.

Tasks

This master thesis can be structured in the following steps:

- Literature review on existing SE algorithms
- Formulation of a weighted LAV SE problem
- Implementation of the solution algorithm for the formulated problem in MATLAB or Python
- Development of test cases: choosing test systems and generating sets of correct/incorrect measurements
- Comparison of the efficiency and accuracy of LAV- and WLS-based algorithms