

Student project proposal

Project title

Implementation and Validation of a Synchrophasor Phasor Estimation Algorithm in EMTP-RV

Project type MSc thesis BA semester project MSc semester project

Project responsible and e-mail

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Project description

As largely documented by the existing literature, the continuous development of stochastic and low-inertia renewable energy sources can significantly impact the fundamental operational aspects of modern power systems. In such a context, an accurate and reliable measurement infrastructure is vital to ensure its adequate operation. Indeed, essential power systems applications like: wide area monitoring, state estimation, control, and protection require time-synchronized measurements provided by Phasor Measurement Units (PMUs). As known, these devices estimate the magnitude, phase angle, frequency, and Rate-Of-Change-Of-Frequency (ROCOF) of the so-called *synchrophasors* associated to AC voltage and current waveforms. Among the wide variety of existing methods used for synchrophasor estimation (SE), those based on the interpolated discrete Fourier transform (IpDFT) have been shown to offer a good trade off between accuracy and computational efficiency when combined with suitable window functions [1]. Over the last decade, multiple IpDFT based SE techniques have been proposed and explored in the literature.

The aim of this project is to implement in a power system dynamic modelling software, EMTP-RV, one of such IpDFT SE algorithms, namely the e-*IpDFT* [1], which exploits the symmetry of the DFT spectrum to approximate and compensate for the effects of the negative image of the fundamental tone. The main goal of the project would be to migrate the existing code of this SE algorithm to EMTP-RV and create a standalone and configurable PMU component which can be tuned based on user selected parameters such as the device sampling rate, the reporting rate, the observation window, the number of self-iterations, etc.

Tasks of the student

- Study and understand the e-*IpDFT* algorithm and its existing implementation in Matlab.
- Implement the e-*IpDFT* for phasor estimation in EMTP-RV.
- Validate the model and demonstrate its performance through different study cases.

Requirements

- Good programming knowledge, preferably Matlab
- Familiarity with EMTP-RV is an asset
- Knowledge of electric power systems is an asset

Literature

- [1] P. Romano and M. Paolone, "Enhanced Interpolated-DFT for Synchrophasor Estimation in FPGAs: Theory, Implementation, and Validation of a PMU Prototype," in *IEEE Transactions on Instrumentation and Measurement*, vol. 63, no. 12, pp. 2824-2836, Dec. 2014.