École Polytechnique Fédérale de Lausanne Distributed Electrical Systems Laboratory EPFL-STI-DESL-ELL, Station 11, CH-1015 Lausanne



http://desl-pwrs.epfl.ch

Student project proposal

Project title

Migration of an existing Synchrophasor Estimation algorithm to C

Project type

MSc thesis

BA semester project

MSc semester project

Project responsible and e-mail César García-Veloso.

cesar.garciaveloso@epfl.ch

Project description

As largely documented by the existing literature, the continuous development of stochastic and lowinertia renewable energy sources can significantly impact the fundamental operational aspects of modern powers systems. In such a context, an accurate and reliable measurement infrastructure is vital to ensure the secure operation of this vital infrastructure. Indeed, the essential power systems applications like: wide area monitoring, state estimation, control and protection do require timesynchronised 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. The aim of this project is to migrate a novel synchrophasor estimation (SE) algorithm from an existing MATLAB/Simulink implementation to C.

The algorithm relies on a quadrature signal generator (QSG) based on the time delay of the input signal samples to attenuate the self-interference of the fundamental tone within the acquired voltage/current signal and allows to deliver a reduction in the total computational cost. The method combines such complex signal generation with a three-point IpDFT and a three-cycle Hanning window to further address the effects of short- and long-range spectral leakage. Migration of the existing code from a prototyping scripting language such as MATLAB to a fast compiled language such as C is a crucial step for the implementation of the method in commercial industry graded embedded devices.

Tasks of the student

- Understand the structure / behaviour of an existing SE algorithm implemented in MATLAB/Simulink.
- Understand the structure of existing C code implementations of different existing techniques and controls. Understand the used conventions/style of programming structures and behaviour used in existing C code.
- Migrate the existing SE algorithm from MATLAB/Simulink to C following the existing C code style / structures so that the new resulting SE C code can be directly integrated with other already existing C structures and functions.
- Validate the performance and behaviour of the produced C code.

Requirements

- Good C programming skills. Familiarity with CCSTUDIO IDE is a merit.
- Good Matlab programming skills or at least capability to read/understand Matlab code.
- Good Git / Version control skills.

Literature

SE algorithm detailed description: <u>https://infoscience.epfl.ch/record/306798</u>