École Polytechnique Fédérale de Lausanne
Distributed Electrical Systems Laboratory
EPFL-STI-DESL-ELL, Station 11, CH-1015 Lausanne
https://desl-pwrs.epfl.ch

Student project proposal

Project type

Real-Time Microgrid Monitoring Via an Embedded Measurement Box: Development and Testing

Project type

☐ MSc thesis ☒ BA semester project ☒ MSc semester project

Project Responsible and e-mail

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Project description

An accurate and reliable measurement infrastructure is vital to ensure a secure and robust operation of electric power systems across all voltage levels. This is especially relevant in those systems with high penetration of stochastic sources, e.g. converter-interfaced renewable generators, and reduced inertia, e.g. islanded systems and/or microgrids.

The Distributed Electrical Systems Laboratory (DESL) operates a fully functional microgrid system connected to the main campus distribution system and characterized by a variety of load types and generation sources [1]. The network is equipped with P-class compliant PMUs which offer real-time monitoring and observability capabilities [2, 3]. Recently, two state-of-the-art measurement boxes equipped with high-accuracy voltage and current transformers have been acquired to expand the monitoring capabilities as well as to characterize the performance of installed equipment. To fully take advantage of their capabilities, specific tailor-made data acquisition and processing routines must be programmed and implemented within the CompactRIO platform at their core.

The purpose of this project is thus to develop such routines in a LabVIEW programming environment, deploy them, and validate them within the real microgrid infrastructure. This will provide the student with hands-on experience with measurement systems widely used as well as with familiarity with monitoring equipment used in the power industry. Complementarily, software development skills as well as hands-on experience with the challenges of programming and testing embedded systems will be acquired. Overall, this makes the project specially suitable for those students with a strong interest in embedded systems, power systems, signal processing, and/or software development.

Tasks of the student

- Implement signal acquisition and power quality processing techniques in LabVIEW.
- Deploy and experimentally validate those techniques within the Measurement boxes located at the DESL microgrid.
- Assess the power quality and the performance of the converters at the microgrid.

Requirements

- LabVIEW Programming and FPGA or Embedded Systems Programming
- Knowledge of Signal Processing
- Familiarity with Software Development and version control systems is a merit

References

[1] R. K. Gupta, "Methods for grid-aware operation and planning of active distribution networks," en, Ph.D. dissertation, EPFL, Lausanne, 2023.

[2] P. Romano and M. Paolone, "Enhanced interpolated-dft for synchrophasor estimation in fpgas: Theory, implementation, and validation of a pmu prototype," *IEEE Transactions on Instrumentation and Measurement*, vol. 63, no. 12, pp. 2824–2836, 2014.

[3] "Ieee/iec international standard - measuring relays and protection equipment - part 118-1: Synchrophasor for power systems - measurements," *IEC/IEEE 60255-118-1:2018*, pp. 1–78, 2018.