RWTH AACHEN UNIVERSITY

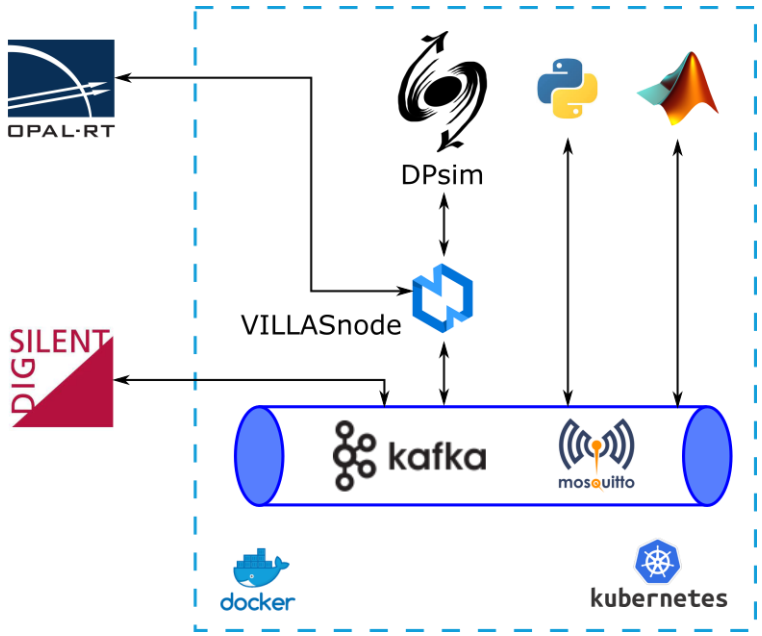
E.ON Energy Research Center
ACS | Institute for Automation of Complex Power Systems

Hiwi/Bachelor Thesis/Master Thesis:

Co-simulation of Power Systems using Shifted-Frequency Analysis

Context:
The energy transition is bringing an increasing interaction of the conventional power grid with different systems including cyber-physical systems, digitalization and communications infrastructure, and a high penetration of low-inertia generation. This interaction is becoming more important for developing and testing monitoring and control strategies to preserve the stability, reliability, and power quality in the energy transition context. Implementing a simulation with enough level of detail is challenging considering the scale and complexity of the resulting system, specially if the interest is on implementing digital twins for supporting model-based design processes.

To face this challenge, Co-simulation takes advantage of available specialized simulators and couples them using modelling and numerical techniques, as well as communication strategies. This makes developer teams to focus on improving their own simulation packages and allows to keep intellectual property by maintaining the implementation details closed and exchanging only relevant outputs.



In this project, we will explore the combination of numerical methods used for co-simulation coupling with methods aimed for the real-time simulation of Power Systems, specifically Shifted-Frequency Analysis. In this regard, we are looking for a student to implement Power

System co-simulation scenarios and develop and validate methods based on Shifted-Frequency Analysis for simulator coupling, using commercial and open-source simulators and different technologies for communicating them. Specifically, we will use DPsim, which is a real-time open-source simulation package implemented at ACS.

Tasks:
The scope of the thesis makes it suitable for a master thesis. The key aspects of this project are summarized into the following tasks:

- Reviewing the main theoretical aspects of trigonometric extrapolation methods
- Proposing a method which extends trigonometric extrapolation with Shifted Frequency Analysis, and analyzing its stability and convergence
- Validating the method in a power system scenario co-simulation

Your profile:

- Good knowledge of C++ and Python
- Experience in power system modeling is not necessary, but preferable
- Knowledge in Matlab/Simulink is a plus
- A good level of English is required

If you are interested in the advertised position, please send your CV and current grades

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