Karlsruhe Institute of Technology

ENERGY LAB 2.0

Master's Thesis Electrical Engineering at Energy Lab 2.0

Load Sensitivity Accuracy Requirements for Voltage-Based Power Control

Thesis Description:

To facilitate and support the continuous flow of electricity, ancillary services are not only provided by generation units, but can be extended to the electrical loads themselves. For example, adjusting the voltage on the low-voltage side affects the power consumption of the connected loads, thereby compensating for the imbalance between generation and demand. Solid-State Transformers (SST) can act as a grid-forming unit for the demand side, adjusting the voltage amplitude and frequency. It is possible to directly control the power of the loads by changing the voltage setpoint, where a good accuracy can be achieved with a proportional controller based on the calculated load sensitivity.
This thesis aims to study the advantages of a control based on the load sensitivity, and to study the accuracy requirements to archive it.

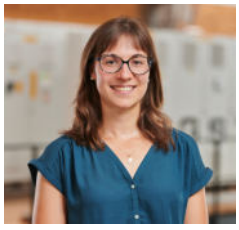
Milestones:

- Simulation environment:
  - Create a simulation environment based on a simple generator and loads
  - Implement a proportional controller based on the load sensitivity and estimate the control error
- Control parameters:
  - Analyze the sources of errors in the load sensitivity calculation
  - Study the impact of the load sensitivity calculation error on the control accuracy
  - Analyze the impact of the power and voltage measurement errors on the load sensitivity calculation and on the control accuracy
- Power Hardware-In-the-Loop implementation:
  - Demonstrate the accuracy requirements in a Power Hardware-In-the-Loop setup by comparing the control accuracy using different parameters

Your Profile:

- Experience with Matlab/Simulink ((+) Mathematica)
- Basic knowledge of control theory
- Rigorous analytical skills

Contact:



Maëva Courcelle

Campus Nord

ITEP: Geb. 410 R.122
Tel.: 0721 608-24084
Mail: maeva.courcelle@kit.edu

Academic supervisor: Giovanni De Carne
Semester: Summer/Winter 2024