Karlsruhe Institute of Technology

ENERGY LAB 2.0

Master's Thesis Electrical Engineering at Energy Lab 2.0

Analysis of Perturbation and Detection Requirements for Perturbation-Based Load Sensitivity Calculation

Thesis Description:

With the increase of intermittent and distributed energy resources, some works focus on the integration of loads to support the electrical grid. By changing the voltage amplitude or frequency, the loads may vary their power consumption. The so-called voltage-based power control can be applied by a solid-state transformer (SST). However, for more accurate control, the load sensitivity should be calculated. Since the load composition changes over time, the load sensitivity must be updated, for example, by using a small voltage perturbation generated by the SST, which is detected by an algorithm and used to calculate the load sensitivity.
The goal of this thesis is to analyze and define the best perturbation type (amplitude, duration, shape, period) that is the most suitable to calculate the load sensitivity with higher accuracy.

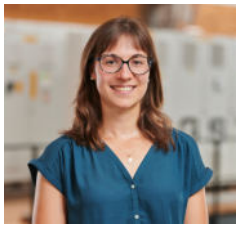
Milestones:

- Simulation environment:
  - Create a simulation environment based on a simple generator and different types of loads (passive and active loads)
- Perturbation analysis:
  - Create a benchmark of perturbations and analyze the load behavior
  - Study the limits of the perturbation for the load sensitivity calculation (e.g., in the case of active resources: delay, recovery)
  - Analyze the impact of the perturbation on the grid level (e.g. possible detection by mart meters with different resolution)
- Perturbation detection:
  - Analyze the measurement requirements for the perturbation detection (sampling time, accuracy)
  - Test the perturbation/detection in a near-real environment (noise, changing load composition, higher aggregation level)
- (+) Implement the perturbation/detection algorithm in a Power Hardware-In-the-Loop setup

Your Profile:

- Experience with Matlab/Simulink
- Proactive
- Rigorous analytical skills

Contact:



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