

# Master Thesis

## State Estimation in Low Voltage Grids – Comparison of Approaches and Algorithms

### Motivation

Due to ongoing developments in high-power consumers (e.g. electric vehicle charging stations, heat pumps or air-conditioning systems) on the one hand and renewable energy sources (e.g. photovoltaic systems, CHP) combined with prosumers (e.g. battery storage, energy and load control) on the other hand, existing low-voltage distribution grids are facing new challenges with regard to the management of an efficient and effective load flow, but also with regard to the behaviour in the event of a fault like a short circuit. Possible approaches for overcoming the corresponding challenges consist of a detailed, at best real-time-capable mapping ("Digital Twin") of the low-voltage distribution grid for better evaluation of the current grid status. The measurement data required for this can be generated in the future by existing measurement technology in the grid (e.g. smart meters), but also by additional sensors. However, permanent monitoring – for example due to missing or faulty measurement data – is not to be expected, which is why state estimation is necessary at low-voltage level.

### Research Topics

- Which methods, approaches and algorithms for state estimation at low voltage level are current practice or state of the art? (advantages, disadvantages, prerequisites, applicability, etc.)
- Can the researched methods, approaches and algorithms be used or implemented in different grids – regardless of their grid level / voltage level (low, medium or high voltage)?
- What advantages, disadvantages and obstacles are to be expected in their implementation?
- To what extent can smart meter data be integrated into these methods?

### Procedure/Methodology/Task definition

- In-depth literature research on the above-mentioned research questions;
- Summary and comparison of the researched methods, approaches and algorithms;
- Evaluation of their applicability with regard to the research questions mentioned;
- Implementation of the researched methods, approaches and algorithms in existing sample grid models (MATLAB, DIGSILENT Power Factory, Python if necessary).
- Presentation of the results or findings in the course of the LV Master-Seminarprojekt [ET oder ET-Wirtschaft] („Master-Seminar“) and documentation in the form of the Master's thesis;

### Organisational Issues

**Begin immediately**

### Contact Person/Supervisor

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