Manipulation of controllable Loads in Smart Homes and Distribution Grids - Impact onto Power System Stability

Master- or Bachelorthesis

The transition in power generation to so called smart grids brings with it the increased use of information and communication technology (ICT) at the distribution grid level. In the future, more and more controllable loads (e.g. charging stations for electric mobility or heat pumps) will be connected via communication technology e.g. telecontrol, smart metering systems or smart home systems. This poses new challenges for grid operation, especially in the area of IT security, since cyberattacks on a large number of controllable distributed loads connected to the control systems of network operators and/or IoT platforms can have a direct impact on safe and stable electrical network operation.

The aim of this thesis is to evaluate the effects of manipulation strategies of a large number of controllable loads in several distribution network areas on the system stability. For this purpose, after the implementation of dynamic load models, manipulation strategies are to be integrated into an existing simulation environment for the dynamic time-domain simulation of power systems and stability studies are to be carried out for various scenarios. Subsequently, the criticality of the manipulation strategies will be derived on the basis of technical evaluation criteria (e.g. on the basis of operating limits).

Goals and core tasks of the thesis

- Literature research on cyberattacks on power systems, power system stability
- Implementation of manipulation strategies for controllable loads and evaluation criteria for power system stability
- Implementation of dynamic load models (e.g. charging stations, heat pumps)
- Performance of stability investigations of the energy system using dynamic time-domain simulations

Your profile

- Study of engineering or business engineering (electrical engineering, electrical power engineering, systems & automation)
- Interest in dynamic time-domain simulation
- Knowledge of MATLAB® is an advantage

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Focus

- Cyberattacks
- Power System stability
- Dynamic time-domain simulation