

Masterarbeit

Forschungsgebiet: Elektrische Energieversorgungssysteme

Voltage Control in the National Interconnected Transmission System (NITS) of Ghana

The ever growing load demand in power systems coupled with corresponding grid expansion to meet the demand introduces new operational conditions and complexities in the power system. Power system operators are thus faced with the challenge of maintaining the quality of power supply despite these complexities. Voltage is one of the main parameters used to assess the quality of power supply. Different voltage control methods (transformer tap changers, generator excitation control and compensation devices) exist, with which voltages in the power system are regulated. The control of synchronous generator excitation as a means of voltage control, which will be the focus of this thesis, is very essential to the investigation of the dynamic behaviour of the power system, especially as synchronous generators serve as the main source of electrical power in the power system.

To accurately simulate the behaviour of synchronous machines in stability analysis, as is being done in an ongoing stability analysis of the Ghanaian power system, synchronous generator excitation systems need to be modelled in detail and investigated thoroughly. The main aim of the master thesis will thus be to evaluate the generator excitation system models currently being used in Ghana and investigate their effects on the voltage stability of the system.

The response of the system voltage to different operating conditions and disturbances such as load changes, generator and transmission line loss as well as short-circuit faults will be investigated using different excitation system models. The simulations in this thesis will be implemented in the DIgSILENT PowerFactory Simulation Tool using a generic power system model as well as the model of the Ghanaian transmission network. The basic prerequisite for this thesis will be the successful attendance of the lectures 'Power Systems' and 'Control Systems' (Elektrische Energieversorgungssysteme and Regelungstechnik). The master thesis could be written in either **English** or **German**.

Proposed work breakdown:

- Basic knowledge and understanding of voltage control in power systems
- Familiarization of the DIgSILENT PowerFactory Software
- Literature review on the different voltage control methods/strategies
- Comprehensive evaluation of the excitation systems used in the Ghanaian power system
- Investigating the behavior of the excitation systems under different operation conditions

Im Anschluss an diese Arbeit ist in einem Vortrag über die Ergebnisse zu berichten.

Die Arbeit ist ab sofort an Studentinnen und Studenten der Elektro-/Informationstechnik und des Wirtschaftsingenieurwesens als Masterarbeit zu vergeben.

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