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Fakultät für
Elektrotechnik und
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Institut für Energiesysteme,
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Masterthesis for N.N.

Quantum-Computing for Power System Applications

In theory, quantum computing has the potential to solve specific computational problems exponentially faster than classical computers. Flexible and volatile power systems with grid operation closer to the limits require larger models and drastically accelerated power system computation. However, the technology of quantum computers is not mature and power system applications are in their infant status of development.

Different kinds of real or emulated quantum computer environments are currently available for research purposes. These different kinds of computers require special formulations of mathematical problems to be solved. Therefore, the well-known power systems applications need to be reformulated in a special way to make them applicable for quantum computers. In the international research, there are only very few groups that attempt to solve classical power system calculations with quantum computing, like power flow, unit commitment or EMT-simulations. Most of them use emulated quantum computing environments.

This thesis shall review the attempts from the literature and the options for quantum computing. For one selected power system problem the calculation shall be reformulated for a selected quantum computing environment. The evaluation of test runs shall identify research opportunities and estimate the practical potential of quantum computing for power system applications.

The following working structure is proposed:

- Literature review on power system applications of quantum computing
- Evaluation of different kinds of quantum computers and options for setting up computation examples (access to real quantum computers versus simulated quantum computation)
- Formulation and implementation of a first application case (power flow calculation or unit commitment) on a quantum computing environment
- Evaluation of the results regarding future application potential

Following this thesis, the results of the work will be reported in a presentation.

Start of work: xx.xx.2022
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The thesis is suitable for students of electrical engineering, automation&robotics, physics or computer science with strong interest in mathematical computation.

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