Bachelor thesis   Date: 01.01.2023

Creation and validation of Typhoon models on MATLAB Simulink basis

In Germany, as part of the energy transition, powerful large-scale power plants, including nuclear and coal-fired power plants, are being disconnected from the grid one after the other and then shut down. These lost capacities are to be replaced by decentralized energy generation, namely photovoltaics and wind power. This will be accompanied by a gradual shift of energy feed-in away from the transmission grid level to the distribution grid. The resulting bidirectional power flows pose new challenges for grid operators, but modern measurement technology in combination with intelligent algorithms can be used to counter the problem of inverting power flows.

In order to check mentioned algorithms on posed requirements, one uses among other things dynamic models. These are implemented in suitable simulation environments, like e.g. MATLAB Simulink or Typhoon. In the laboratory, in the course of validating these algorithms, additional elaborated test environments are created that transfer a small part of the simulation to the real world. By integrating individual hardware components into the calculations, another way to check the simulation and its assumptions for consistency is created. This concept requires the use of real-time simulators and is referred to as Hardware-In-The-Loop.

In the context of this work, an existing converter will be used to transfer models from MATLAB Simulink to a Typhoon real-time simulator. The goal is to find out how the transformation changes the models and thus the associated calculations. Dynamic network models form the basis for this. First of all, it is necessary to implement the block diagrams, which are already available in MATLAB Simulink, in the simulation environment of the real-time simulator. It is advisable to first familiarize with the general modeling architecture of networks in MATLAB Simulink and Typhoon before considering the converter to be used. Following the implementation, a familiarization with dynamic simulation is to be made in order to be able to check the conversion for correctness and to validate the results. Afterwards, it is to be evaluated exemplarily, how possibly arising differences are to be handled.

The following structuring of the work is proposed:

- Literature research on dynamic modeling and familiarization with the topic
- Determination of the usability of the "MATLAB Simulink to Typhoon" converter
- Exemplary use of the tool for the transfer of network models
- Validation of the implementation, e.g. via load flow calculations

Following the completed work, the results are to be reported in a presentation.

Date of issue: xx.xx.xxxx
Date of delivery: xx.xx.xxxx

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