

Master thesis

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## **Development and testing of an ANN-based method for forecasting the future grid condition of distribution grids**

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In the process of the energy transition, large power plants such as nuclear and coal-fired power plants are being shut down in Germany and replaced by decentralised energy conversion plants such as photovoltaic, wind power, CHP plants and storage units, as well as new decentralised energy resources such as electric vehicles and heat pumps. This results in an increased load on the distribution grids in the form of greater load flows, reversed power flows and greater voltage fluctuations. Network operators and research institutions are addressing this problem by digitalising the lower voltage levels, especially medium and low voltage. They collect or artificially generate measured values at local network stations, cable distribution cabinets and intelligent measuring systems, so-called smart meters, to make the networks observable. In this way, algorithms for preventive and curative congestion management can also be used in the lower voltage levels.

For the use of preventive congestion management, however, data for the future grid state is required. Such data is usually not available in the lower voltage levels due to the lack of schedules for the grid assets. In this master's thesis, a method based on artificial neural networks for predicting grid status data for the next day is to be developed and tested using data from a real low-voltage grid. At the beginning, a comprehensive research on existing procedures for the generation of grid state forecast data in medium and low-voltage networks will be carried out. The procedures are to be evaluated with regard to their complexity, robustness and realisation in grid operation. Based on this, a suitable procedure is to be selected and the algorithm developed. The preferred programming languages are Python and C++. The functionality will then be validated using real data.

The following structuring of the work is proposed:

- Familiarisation with and literature research on the subject area
- Familiarisation with the selected programming language and environment
- Listing and qualitative evaluation of procedures for ANN-based generation of network condition data
- Development of a suitable algorithm
- Generation of scenarios for the application of the algorithm
- Exemplary application of the algorithm at the developed scenarios and evaluation of the procedure

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

This work is now being assigned as a master's thesis to students of electrical/information technology, automation and robotics and industrial engineering.

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