Karlsruhe Institute of Technology

Institute for Automation and Applied Informatics (IAI)

From now
(Runtime 6+ months)

HiWi Job

Implementation of Methods for Reduction of Complexity and Translation of Code from MATLAB to Python/Julia

Key Words: Redispatch Cost Allocation, Optimal Power Flow, Game Theory, Optimization

A current critical issue is that our power grid is increasingly being operated at the limit of its capacity. In order to operate it, the network operators have to find ways of sharing the enormous enormous redispatch costs.

One approach for fair distribution is the Shapley algorithm, which allocates costs to congestion in the grid. Congestions occur every few minutes and are prevented by redispatch, i.e. a redistribution of power generation, which is done with an Optimal Power Flow (OPF). The calculation must be fast in practice, however the Shapley algorithm has a Complexity of $O(2^n)$ for n congestions.

The HiWi implements two methods from a research article that reduce the complexity of both the of the Shapley algorithm, as well as the OPF calculation. The basis is the paper by Voswinkel and Weber [1]. In addition, the code shall be translated from MATLAB into an open-source software Python or Julia. A master thesis based on the topic is probably possible.

Tasks:

- Get to know redispatch and the Shapley-Algorithm
- Implementation of two methods for complexity reduction
- Translation of the MATLAB code into Python or Julia
- Documentation of repository

Education, Experience, and Skills:

- Field of study: computer science, electrical engineering, power systems.
- Good Programming skills in MATLAB, Python/Julia & software development.
- (optional) basic knowledge of optimization
- (optional) basic knowledge of energy informatics

You will work on a current topic in the energy transition and have the chance to learn more about the processes in today's energy grid!

[1] „Sharing congestion management costs among system operators using the Shapley value“ (S. Voswinkel et al.)
https://www.sciencedirect.com/science/article/pii/S030626192200441X

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