

HiWi project:

Optimal power flow as microservice-tool for distribution management system

Context:

During research projects of the ACS Institute a fully distributed optimal power flow (OPF) algorithm has been developed, suitable for different kinds of power systems (AC, DC, AC/DC). In this algorithm, the OPF problem is formulated in nodal form, i.e. the OPF problem is decomposed at each node of the system, providing thus high modularity to the algorithm. In addition, being distributed, the algorithm exhibits high scalability. These features are significant for the system operator of the future distribution grid, where an increasing number of distributed energy resources (DER) will be integrated, being able to switch on and off frequently, and participating actively in the system regulation. The modularity thanks to the nodal decomposition allows the easy update of the OPF algorithm according to the connectivity of different DER, and the scalability of the distributed algorithm facilitates its application to systems with large number of integrated components. Hence, it is of great importance to include this OPF algorithm to the automation platform of the management system of the distribution grid.

Such a distribution management system is provided by the SOGNO platform, which offers modular microservices software solutions for the control center of the distribution system operators. In particular, the SOGNO platform provides an open-source framework with open APIs, where new automation functions can be plugged in as microservices. In this way, the functionalities of the classical SCADA system, transformed now to microservices in the SOGNO platform, can be updated independently and faster.

In this context, this HiWi project will prepare the already developed distributed OPF algorithm to be integrated as microservice in the SOGNO platform.

Your tasks:

The tasks include:

- The study of the developed distributed OPF algorithm, for familiarisation with the structure of the tool, and the developed SOGNO platform and its APIs, to identify interface requirements and limitations.
- The improvement of the OPF algorithm/tool for providing a better microservice: improvements in the solver, as well as in parameters of the algorithm, to facilitate its faster convergence to a more accurate optimal solution; integration of a method to handle communication failures, already developed for the OPF algorithm for DC

systems, and expansion to deal with these issues in the OPF algorithm for AC and AC/DC systems

- Integration of the OPF algorithm to the SOGNO platform, considering the data format of the APIs

The work will be conducted in Python as open-source software tool. The OPF algorithm is already developed in Python code and the SOGNO platform provides such APIs.

Your profile:

- Good knowledge of Python is a prerequisite
- Knowledge of the OPF problem (not necessarily the distributed algorithm, but the mathematical problem formulation) is not necessary, but preferable skill

Our offer:

The work is expected to be completed in a period of 6 months with a workload of 15-17 h/w. The students, who are close to finish their MSc studies and want to continue for a thesis in the field of the OPF algorithms, are strongly encouraged to apply for this HiWi project. The work can be extended in a MSc thesis on the development of stochastic distributed OPF algorithm. The collaboration with the supervisor will be done in English.

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