

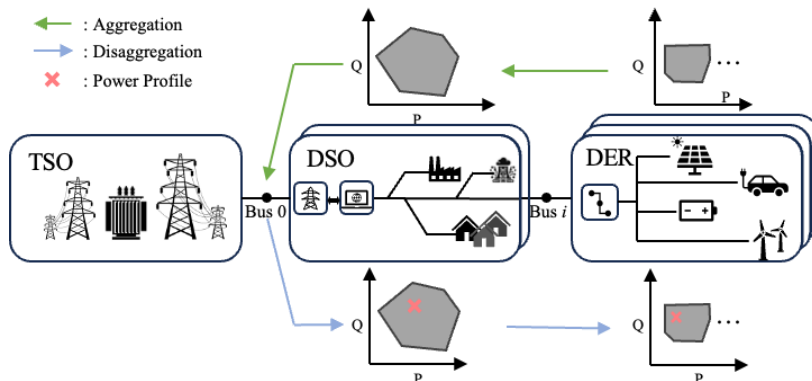
Student work (HiWi)

Exploring Flexibility Aggregation Methods in ITD-System

Scientific Title: Development and Evaluation of Flexibility Aggregation Methods for Coordinated Transmission and Distribution System Operation

The increasing integration of distributed energy resources, including photovoltaic systems, battery storage, electric vehicles, and flexible loads, creates new challenges for power system operation and optimization.

Detailed modelling of a large number of distributed resources can lead to computationally demanding optimization problems. Flexibility aggregation provides compact representations of distribution system capabilities, while stochastic optimization enables uncertainties such as renewable generation and load variations to be considered.



Advisor:

Yanlin Jiang
Frederik Zahn

Programming language:

Matlab/Julia

Required skills (Wish list):

- Have a background in computer science or electrical engineering
- Have basic knowledge of any programming language
- Interest in numerical optimization and power system analysis

Language(s):

English

Starting date:

As soon as possible or date

For more information, please contact:

Yanlin Jiang

E-Mail: zs5766@kit.edu

We are happy to answer any questions you might have. Feel free to ask any question!

Interested students are welcome to send their **CV and transcript of records**

Institute for Automation and Applied Informatics (IAI)
 Karlsruhe Institute of Technology,
 Campus North
 Hermann-von-Helmholtz-Platz 1
 76344 Eggenstein-Leopoldshafen

Main Tasks

Literature Review

Review methods related to flexibility aggregation, numerical optimization, stochastic optimization, and power system analysis.

Model and Algorithm Implementation

Reproduce selected algorithms from the literature and implement them in an existing simulation framework.

Numerical Simulation

Test the implemented methods using transmission and distribution system benchmarks.

Performance Evaluation

Compare solution accuracy, computational efficiency, and scalability.

Documentation

Prepare clear documentation, figures, and summaries of the obtained results.

References

- [1] Y. Jiang, X. Dai, F. Zahn and V. Hagenmeyer, "Enhanced Flexibility Aggregation Using LinDistFlow Model with Loss Compensation," *2025 IEEE Kiel PowerTech*, Kiel, Germany, 2025, pp. 1-6, doi: 10.1109/PowerTech59965.2025.11180670.
- [2] Frank, S., & Rebennack, S. (2016). An introduction to optimal power flow: Theory, formulation, and examples. *IIE Transactions*, 48(12), 1172–1197. <https://doi.org/10.1080/0740817X.2016.1189626>