



Development of a Method for Assessing the Flexibility Potential of Cogeneration Plants

Background

The energy transition requires the adaptation of combined heat and power (CHP) plants to support the integration of renewable energy sources. In this context, the flexible operation of facilities such as waste incineration plants (which dispose of waste while providing heat to district heating networks and electricity to the grid) can be used to effectively respond to volatile electricity demand. To achieve this, it is possible to utilize the inherent flexibility of the plant and the district heating network. Leveraging the thermal inertia of the district heating network, pressure and temperature variations in the steam supply, or actions such as condensate accumulation (reducing condensate return, resulting in temporarily higher power output) can shift the plant's generation. Before implementing control strategies that exploit such measures, it is crucial to evaluate the potential (how long and to what extent can generation be shifted?) so that plant operators can assess the viability of such investments.



Figure 1: Waste incineration cogeneration plant in London, UK.

Objective

This project aims to develop a method that robustly evaluates the flexibility potential of various plants, ideally based solely on plant design data or potentially utilizing a limited number of dynamic tests that can be performed during regular operation. Operational data from a plant, along with a detailed model of the facility and a simplified MATLAB/Simulink model (as shown in Figure 2) that can serve as the basis for this work, are available. To accurately assess the flexibility potential, the MATLAB/Simulink model is to be extended to better represent the steam generator and the district heating network.

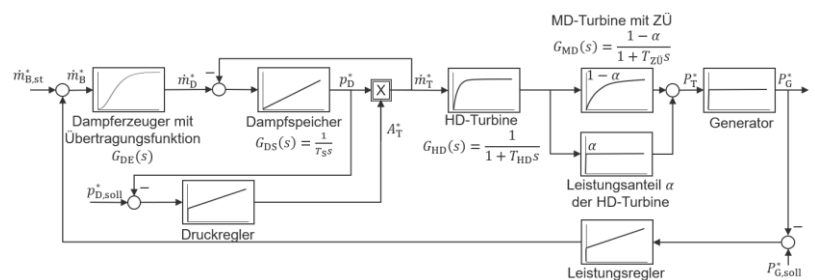


Figure 2: Block diagram of a steam generation plant with reheater.

Approach and tasks

1. Conduct a literature review and familiarize yourself with the existing power plant simulation models in Modelica and MATLAB/Simulink.
2. Enhance the MATLAB/Simulink model in the area of steam generation and district heating.
3. Develop a method for estimating the flexibility potential based on the MATLAB model and its parameters.

4. Create a method for determining model parameters using plant design data.
5. Document your work and discuss the results.

Requirements

- Ability to work independently
- Good knowledge of linear algebra
- Fundamental knowledge of control theory
- Fundamental knowledge of thermodynamics
- Experience with MATLAB/Simulink

Start date: possible immediately.

Interested students please contact

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