Friedrich-Alexander-Universität Erlangen-Nürnberg

Department Chemie- und Bioingenieurwesen (CBI)
Lehrstuhl für Energieverfahrenstechnik
Prof. Dr.-Ing. Jürgen Karl

Masterarbeit

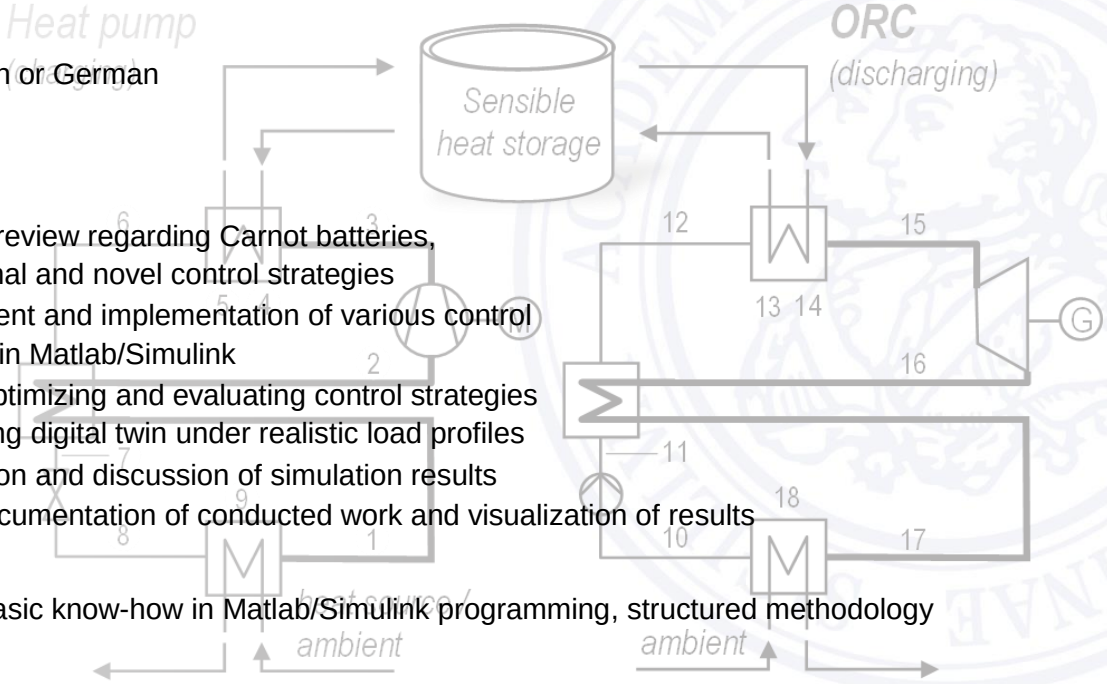
Development of effective and intelligent control strategies for Carnot Batteries

Content:

Carnot batteries are a promising storage technology for electric grids with a growing share of renewables. Compared to other base-load capable storage technologies, like pumped hydro or compressed air energy storages, Carnot batteries are independent of geographical constraints. Especially Carnot batteries based on a heat pump process for charging and an Organic Rankine Cycles for discharging allow the use of readily available components and an effective integration of low-temperature waste heat to boost the efficiency. Although they do not reach as high power-to-power efficiencies as lithium batteries, Carnot batteries allow a less costly extension of the storage capacity which basically consists of a hot water vessel. Intelligent control strategies enhance the efficiency and enable feasible storage solution. by means of Carnot batteries.

In previous works, a digital twin of a Carnot battery prototype has been developed in Matlab/Simulink. Within the scope of this thesis, various control strategies will be developed and implemented in the Simulink environment. The digital twin reflects the dynamics and off-design behavior of the prototype and thus, allows realistic testing of the control strategies under real load profiles. The overall goal is to determine and evaluate effective control strategies for Carnot batteries.

Language: English or German



Tasks:

- Literature review regarding Carnot batteries, conventional and novel control strategies
- Development and implementation of various control strategies in Matlab/Simulink
- Testing, optimizing and evaluating control strategies with existing digital twin under realistic load profiles
- Visualization and discussion of simulation results
- Written documentation of conducted work and visualization of results

Prerequisites: Basic know-how in Matlab/Simulink programming, structured methodology

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