Lehrstuhl Steuerung, Regelung und Systemdynamik

Master Thesis

Literature research, Programming and Simulation

Energy storage systems modeling using physics-based and machine learning methods

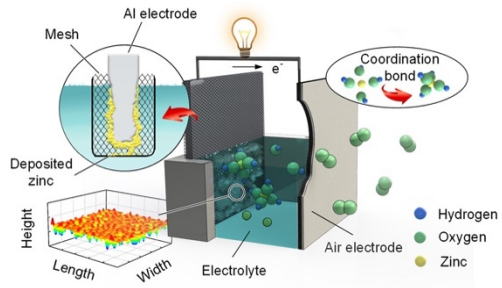
Keywords: Storage system, Battery, Hydrogen, Fuel cells, Charging and discharging

Conditions:

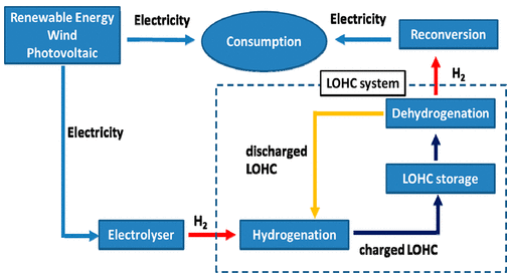
Duration:	6 months
Requirements:	Strong MATLAB knowledge
Language:	English
Target group:	Master students

Contents:

Recently, energy storage systems have played an important role in energy utility. The importance of these systems is related mainly to their role in smoothing the energy flow and minimizing energy waste mostly produced from renewable resources and load fluctuations. Including energy storage systems (ESS) in the energy management controllers allow for actions to control and stabilize the energy flow by providing an opportunity for both the load and the productions sides to change their energy profiles. For these reasons numerous research has been held in this field for different applications and technologies.



[Manhui et al., 2021]



[Modisha et al., 2019]

One of the important parts to understand and improve the working of the storage systems is using simulation tools, which allows access to the dynamics of the technology and generate accurate models comparable to the physical storage systems. In this work, the focus will be on the following technologies: batteries and hydrogen storage systems. The student must passed the Machine Learning exam (by Prof. Söffker).

The goals/steps of this work are:

- Based on literatur review: Defining the different engineering and physical characteristics of each technology type
- Based on literature review: Refining the different usage goals and scales in a city application
- Generating models using machine learning methods and physics based methods of each storage type (taking in consideration the charging/discharging dynamics, capacity, aging …etc.)
- Simulation and comparison of the models of each storage type using MATLAB/Simulink
- Evaluation and validation of the developed models

Complete and detailed documentation/presentation of the research results

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