

## Master thesis

### „Online Electrochemical Impedance Spectroscopy for batteries using a high frequency GaN DC/DC converter“

#### Task:

The group „Efficient and High-Frequency Power Electronics“ develops battery charge controllers with GaN transistors which are operating at high switching frequencies.

These DC/DC converters provide the inherent capability to perform an online Electrochemical Impedance Spectroscopy (EIS) to determine parameters such as State of Charge (SoC) or State of Health (SoH).

The main challenges are the measurement of the responding waveforms to the excitation at different frequencies.

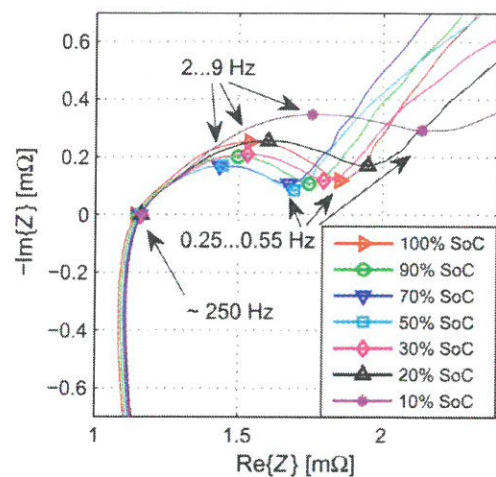
In this thesis, different methods to perform an online EIS shall be evaluated in simulations and with a hardware demonstrator. An existing DC/DC converter shall be adjusted so that it is capable to perform the characterization. Additionally, the software for the microcontroller needs to be programmed in order to determine the phase and amplitude of the responding signal.

The online EIS system shall then also be verified with different batteries available in the lab.

#### Work packages of thesis:

- Literature review on online EIS and DC/DC battery converters
- Simulations of different methods for EIS in PLECS
- Schematics and Layout of revised DC/DC converter in Altium Designer
- Coding the software for TI F28388x in Code Composer
- Commissioning of the converter and test measurements with different batteries
- Presentation and documentation of results

**Focus:** Power Electronics, Electrical Engineering  
**Begin:** September 2021  
**Duration:** At least six months  
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<sup>1</sup> Waag et al., Experimental investigation of the lithium-ion battery impedance characteristic at various conditions and aging states and its influence on the application