Universität Stuttgart

Institut für Photovoltaik (*ipv*)

Elektrische Energiespeichersysteme (*ipv*-EES),
Batterie Systeme

Master thesis

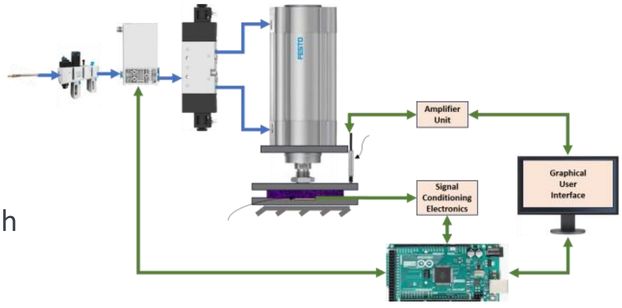
Design and Validation of a Cell Press to Achieve Uniform Loading for Aging Studies of Li-Ion Pouch Cells

As a power source characterized by time-varying and non-linear behaviors, lithium-ion batteries undergo a multitude of interconnected side reactions. These reactions lead to a decline in performance over their lifetime. Such degradation can be diagnosed by capacity fade or resistance increase. Furthermore, after prolonged aging, lithium-ion batteries often exhibit non-linear aging characteristics, frequently accompanied by an accelerated capacity fade at a certain “knee point.” This abrupt decline in performance drastically shortens the lifespan. Therefore, estimating and predicting the initiation of this non-linear degradation is essential in practical applications. In addition to monitoring capacity fade, mechanical signal detection methods can provide additional information beyond electrical measurements.

In this work, we plan to investigate the pressure dependence of battery aging in an accelerated manner by applying advanced methodologies such as power capability testing and high-precision coulometry. These analyses will be conducted using a pressure-controlled pneumatic test bench to track the fingerprint indicators of the onset of non-linear aging.

What We Offer:

- Acquisition of hands-on experience with advanced experimental setups
- Contribute to an impactful research in the field of energy storage
- Collaborative and highly-supportive research environment



Tasks:

- Improvement of the current testbench
- Reinforcement of the clamping fixture
- Implementation of a closed-loop pressure control strategy (e.g., PID control).
- Optimization of the Arduino-based firmware and PCB design based on the current circuit.
- Validation of the improved system,
- In-situ recording of force and expansion
- Advanced battery testing
- Data processing and Analysis

Required Skills:

- Mechanical or Mechatronics Engineering, Electrical Engineering, or related field
- Practical experience with mechanical design and prototyping
- Basic knowledge of control systems (PID control is an advantage)
- Experience with Arduino or embedded microcontrollers or PCB design
- Ability to work independently and systematically
- Basic matlab or python knowledge for data processing

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