Progress in BMS Simulation of the Smart-Pack-for-Advanced-Research-and-Control (SPARC)

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ARTS-Lab
Adaptive Real-Time Systems Laboratory

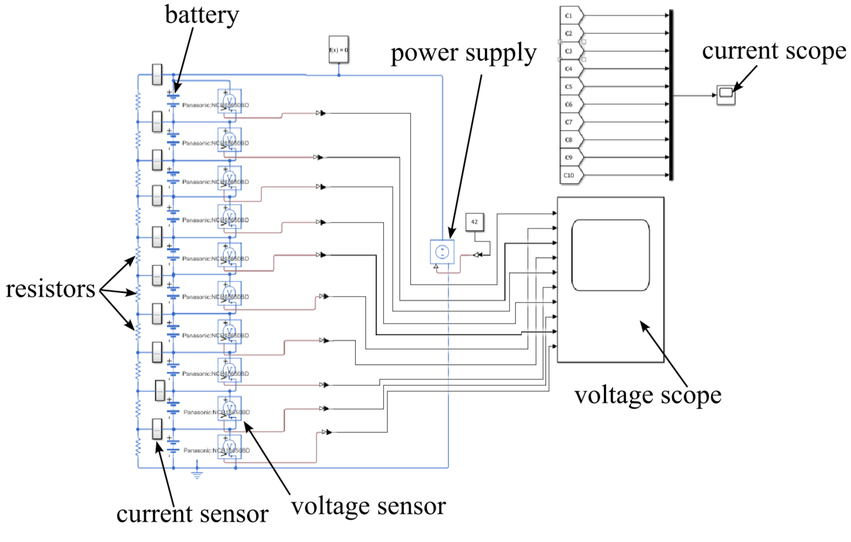
Overview

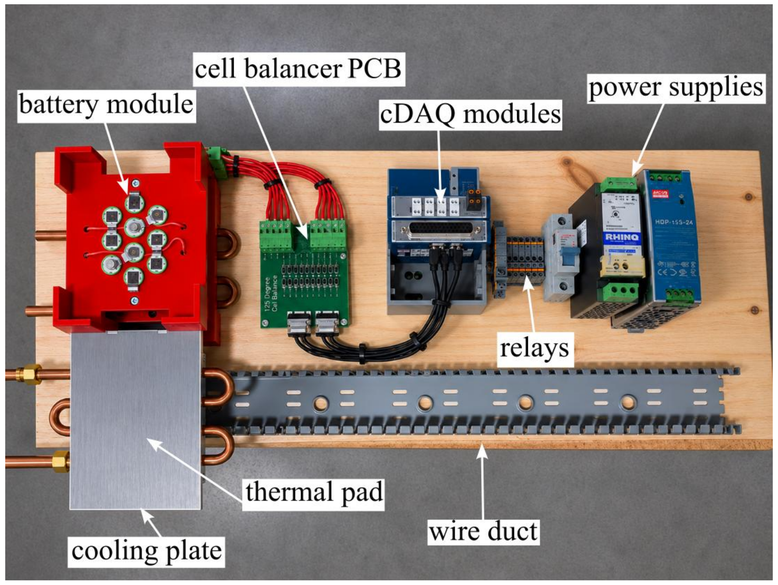
- 10s1p battery module
- 18650 cells (expansion to other chemistries in the future)
- Extensive sensing through cdaq modules (Strain, temperature, voltage, current)
- Liquid cooled with two cooling plates
- Passive cell balancing

Battery module Itself

- Custom made 3d prints that allow for pressure to be applied directly to the cells.
- Currently designed for 18650 cells but will branch out in the future
- Sense wire soldered onto nickel strip between each cell
- Thermocouples attached at 4 corners of the module
- Modules in the future will be fully insulated with spray foam put in-between the cells

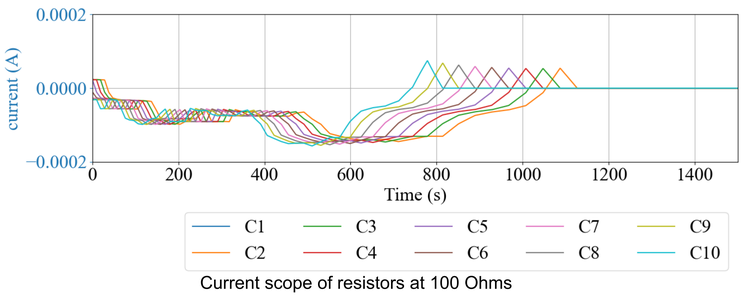
Simulink Model with Cell Balancing



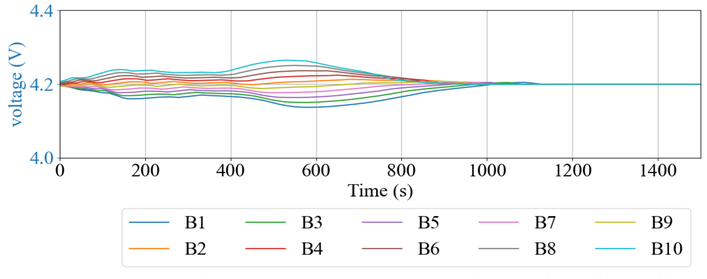


Full pack mockup (AI image generated by prompting ChatGPT with an image of the prototype).

Voltage and current scope



Current scope of resistors at 100 Ohms



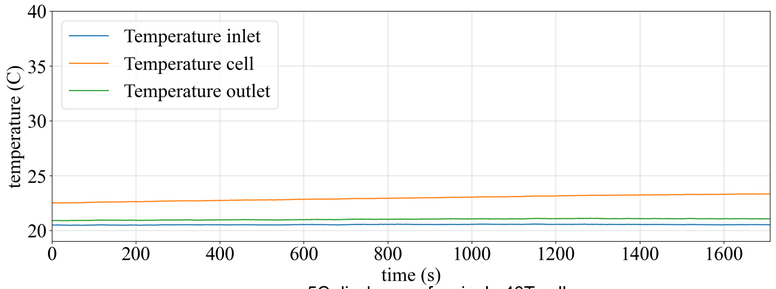
Voltage scope of each battery in increasing state of charge from 40% to 49%

Future methodology

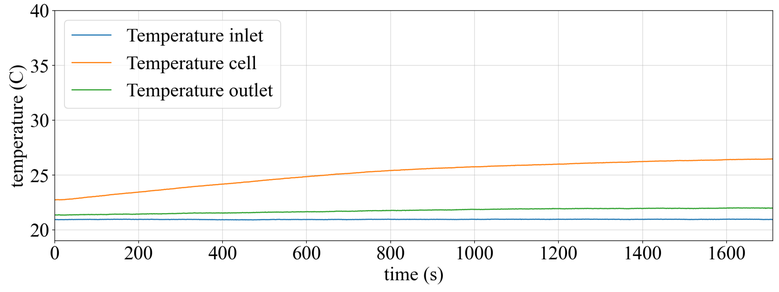
- Run discharge, wait, charge tests on a NHR 9200 power supply with variable discharge C rates
- HPPC tests on a NHR 9200 power supply for 20 cycles or until the pack hits 25 volts
- Run the same tests mentioned above while the pack is on a shaker table

Temperature data collected on single cells

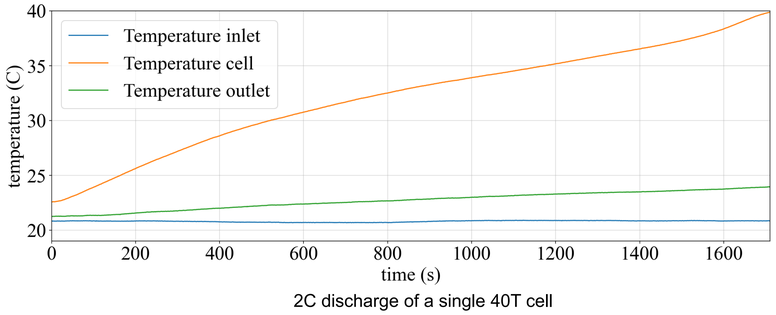
- These results will be compared to the pack when it is ran under the same parameters



.5C discharge of a single 40T cell



1C discharge of a single 40T cell



2C discharge of a single 40T cell

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