Battery Pack Design and Characterization

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EECOMOBILITY (ORF) & HEVPD&D CREATE

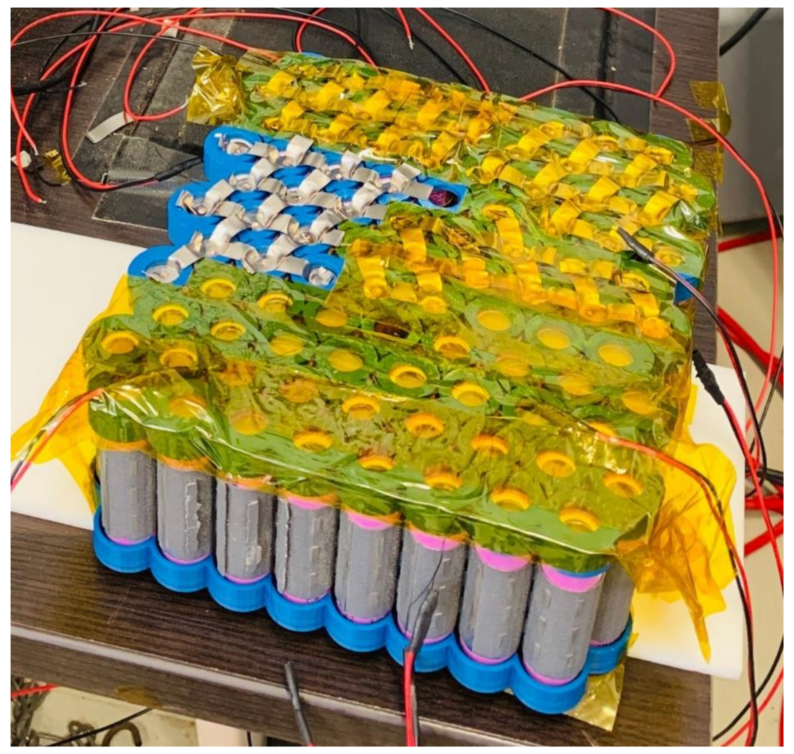
Motivation

- Battery packs consist of hundreds to thousands of cells
- Applying cell-level state estimators directly is (usually) not feasible
  - Individual cell currents not available in parallel-connected groups
  - Computational cost
- Existing pack-level models:
  - Lumped model
  - Assume knowledge of individual cell current and voltage
  - Estimate cell states using adaptive filtering methods (Kalman filters)

48V Battery Module Design

Samsung cylindrical cell module

- 13s7p
- 3D printed aluminium lattice



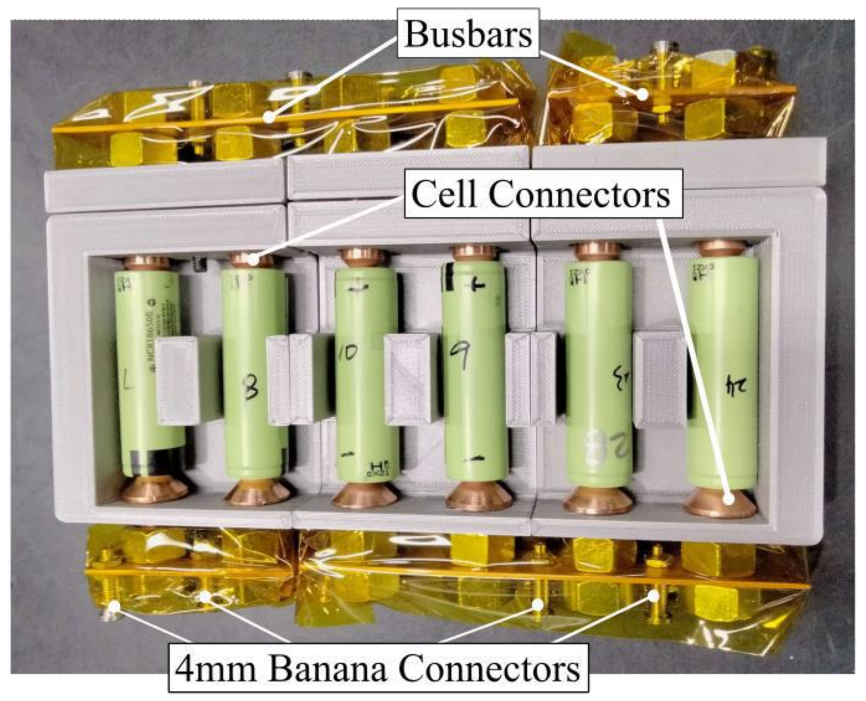
NRC pouch cell module:

- 13s1p
- Novel chemistry, high energy density

Module-level EIS Characterization

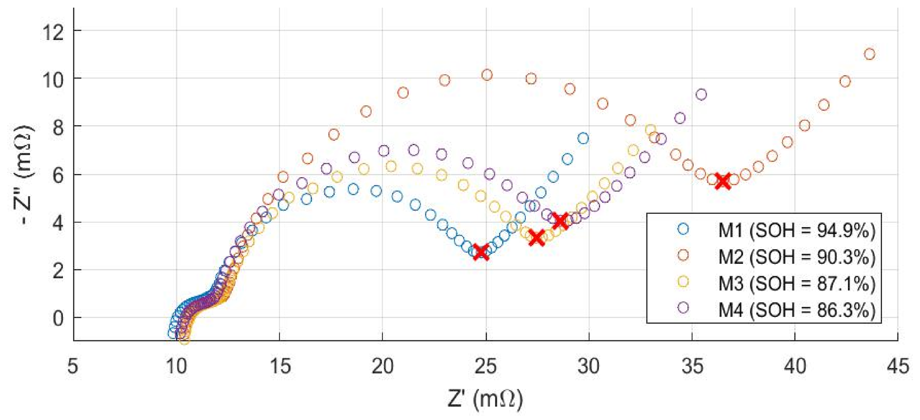
Setup:

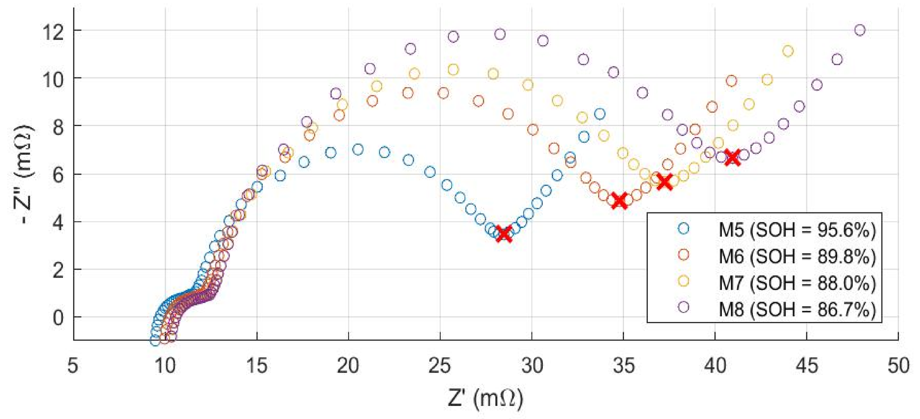
- Custom battery fixture
- Module configuration: 4P1S
- EIS settings:
  - 25 °C
  - 5000 – 0.005 Hz
  - Galvanostatic, 0.13A

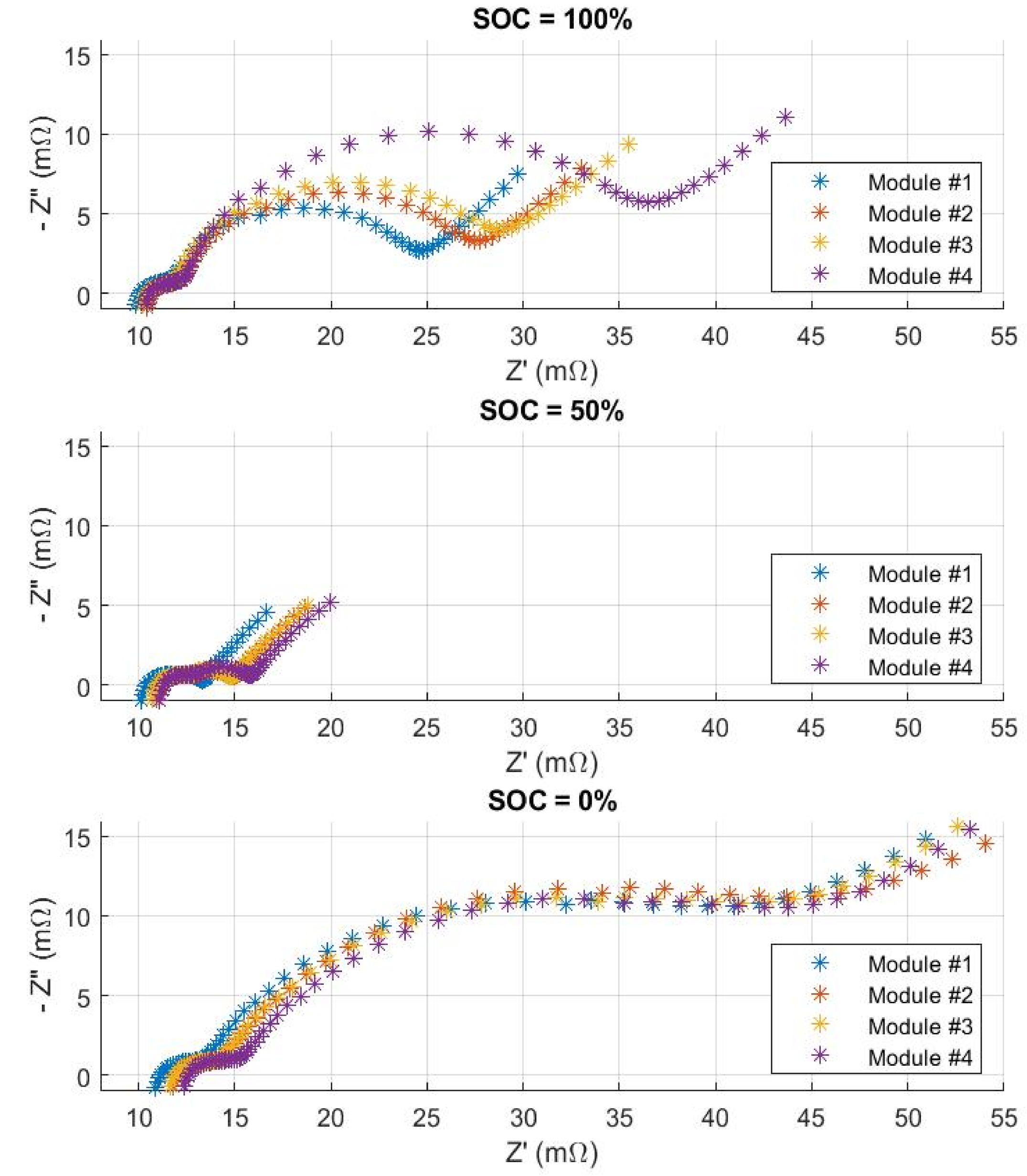


Results:

- Impedance increases as SOH decreases
- Transition frequency between 0.025 to 0.050 Hz
- 100% SOC provides the best separability between modules with high impedance







Conclusion:

- Impedance can reflect module SOH
- A narrow and low frequency range may be sufficient
- Potential use in state estimation, fault detection, and rapid battery sorting
- Working to expand results to more module configurations, operating conditions and developing impedance-based battery management and state estimation strategies

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