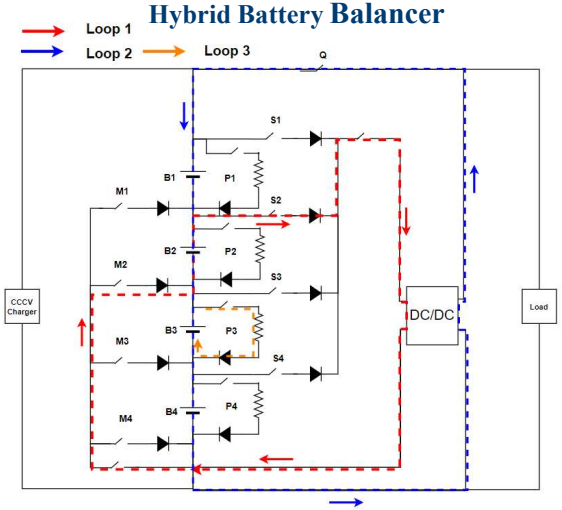
Battery Balancers for Second Life Conversion

Alvin Huynh, Phd. Student | Supervisor: Sheldon Williamson

Hybrid Battery Balancer

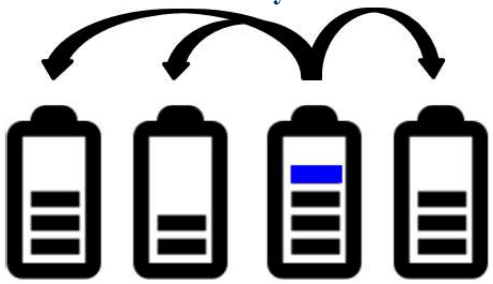


Battery balancers typically equalize voltages or State of Charge to ensure batteries operate similarly. All BMSs will have a balancer, typically utilizing passive balancing.

Passive Battery Balancer



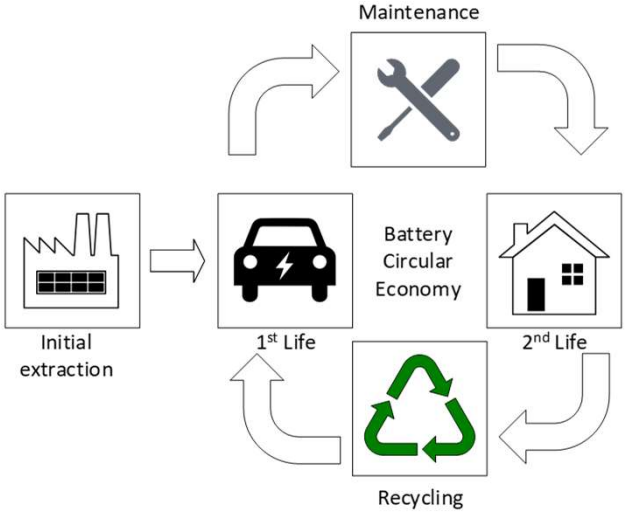
Active Battery Balancer



Balancer	Speed	Cost	Complexity	Benefit
Passive	Slow	Low	Low	Cost
Active	Fast	High	High	Speed
Hybrid	Fast	High	Highest	Adaptability

The research is development of methodology of battery maintenance using battery balancers for second life. With the sharp rise of EV adoption, battery maintenance and retirement have been left on the back burner. A methodology needs to be developed to allow for second life conversion and maintenance to extend battery life.

Ideal Battery Circular Economy

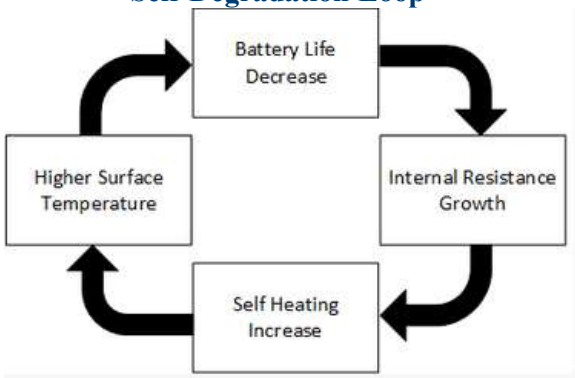


Conversion Processes

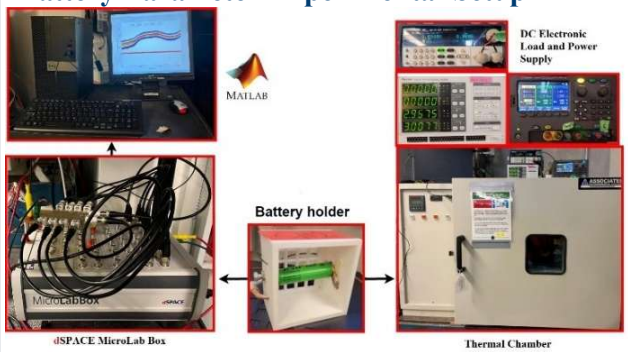
End of life processing methods	Description
Direct Reuse	Reimplementation of batteries directly from primary life
Remanufacturing	Extraction of only the healthy cells for reuse
Reconditioning	Cycling individual cell to change degradation rates
Recycling	Destruction of batteries and extraction or rare materials

Integrating the SOH prediction to the balancing topologies allows for the possibility of reconditioning without major structural changes. Further implementation will allow for parallel connections to existing BMSs and validation of extended usefulness.

Self-Degradation Loop



Battery Parameter Experimental Setup



Using combination of electro impedance spectroscopy, internal resistance readings and temperature readings a mapping of a cell's degradation can be made to help the balancer. The parameters are accurate with a fit up to 92%.

Internal Resistance vs Temperature vs SOH

