Strain Estimation Technology for Lithium-Ion Batteries

Southwest Research Institute
Jeff Xu, Principal Scientist and
Joe Steiber, Principal Engineer
210.522.5103/jeff.xu@swri.org
210.522.2629/jsteiber@swri.org

Technology

The project objectives are to identify an innovative and online sensing technology to be able to detect the lithium-ion battery state of charge (SOC) and the state of health (SOH) through strain-gauge-based model and control algorithms. Mathematical formulations that can accurately define the correlation between strain versus SOC/SOH will be transferred into a representation appropriate for in-vehicle control system development.

Advantage and Differentiation

Unlike present SOC/SOH estimations that rely primarily on indirect determination based on OCV and coulomb counting, SwRI's approach is to combine fast, direct sensing hardware with modern control algorithms. It is targeted to enhance the controllability and potential reliability of a vehicle's battery pack as well as Utilities' energy storage systems by providing the following benefits:

- More accurate and direct feedback of SOC/SOH to BMS
- Potentially more robust measurement of internal states
- Scalability to any battery pack size and configuration at low-cost sensing of hardware
- Augments (not displaces) existing solutions by providing redundancy
- SOC/SOH estimation executed in a low-cost control unit

Performance Targets

The goals of the project are:

1. Establish design of 48 experiments for evaluating cell chemistry, form factor, and temperature dependencies
2. Design custom hardware for testing
3. Design, implement, and demonstrate estimation algorithms using low-cost hardware controller

Metrics	State-of-Art	SwRI
SOC accuracy	~5%	2% over life
SOH accuracy	N/A	0.00125%/custom cycle

Please contact regarding: r&d collaboration, funding, press