Hawaiʻi Natural Energy Institute Research Highlights

Electrochemical Power Systems

Battery Diagnosis and Prognosis

OBJECTIVE AND SIGNIFICANCE: Development of tools, protocols, and new approaches to improve batteries diagnosis and prognosis via non-invasive in-operando techniques.

BACKGROUND: Battery diagnosis and prognosis is a difficult task. Lithium-ion batteries (LiB) are much more complex than traditional batteries and their degradation is path dependent as different usages (current, temperature, SOC range, SOC window…, etc.) will lead to different degradation. Also, large battery packs are comprised of thousands of cells. This precludes the practical use of complex models or a multitude of sensors for each cell.

Traditionally, battery diagnosis is handled via two opposite approaches. The academic route aims for maximum accuracy and achieves it by inputting a lot of resources. The second route -- the one usually used on deployed systems -- is opposite and uses as little resources as possible and must not be destructive. As a result, it is ineffective in predicting the true state of health of the cells.

This assessment of state of the art led HNEI to define and develop a third industry-compatible intermediate route to reach an accurate diagnosis with a cost-effective and non-destructive method, using only sensors already available in battery packs while requiring limiting computing power.

Machine learning and artificial intelligence are starting to play a crucial role to diagnose and prognose batteries. However, their accuracy is limited by the little to no training data available to validate algorithms. To solve this issue, HNEI used its experience to develop the first synthetic training datasets using computer-generated voltage curves. Research conducted for this project is completed in the **PakaLi Battery Laboratory**.

PROJECT STATUS/RESULTS: This project is currently ongoing. A full suite of software and models were developed. The main model has been licensed by more than 65 organizations worldwide. This work led to 35 publications and one patent.

Latest publication: 2020, M. Dubarry, D. Beck, **Big data training data for artificial intelligence-based Li-ion diagnosis and prognosis**, Journal of Power Sources, Vol. 479, Paper 228806.

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