Smart Battery Management System for Electric Vehicles: Selflearning Algorithms for Simultaneous State and Parameter Estimation, and Stress Detection Dataset

Dataset available at: https://digitalcommons.lsu.edu/transet_data/116/

(This dataset supports report **Smart Battery Management System for Electric Vehicles: Self-learning Algorithms for Simultaneous State and Parameter Estimation, and Stress Detection**)

The related final report **Smart Battery Management System for Electric Vehicles: Self-learning Algorithms for Simultaneous State and Parameter Estimation, and Stress Detection**, is available from the National Transportation Library's Digital Repository at https://rosap.ntl.bts.gov/view/dot/61752.

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Abstract: The project proposes to develop parameter-varying SOH-coupled models for lithium-ion battery and self-learning algorithms to learn the model for simultaneous state and parameter estimation and fault detection. The traditional battery models use constant parameters, limiting their accuracy for predicting the state of the charge and health over the complete life-cycle. In practice, the battery parameters vary with the change in the state of charge and state of health. SOH-coupled models can be used to estimate the state of charge and health accurately. Further, obtaining the model parameters is also a challenging task for designing filters or observers for state estimation. A self-learning algorithm can eliminate the requirement of the model parameters. In this project, three SOH-coupled models are proposed and validated experimentally. The models are also used to design extended Kalman filters (EKF) for the state of charge, state of health, core and surface temperature, and internal resistance estimation. The results showed that the SOHcoupled models are more effective when compared to the uncoupled models in the literature. Further, it was found that EKFs based state estimation errors were within 1%. The self-learning algorithm using a two-layer neural network showed the ability to learn the models in real-time. However, the state estimation errors are higher for the self-learning scheme compared to the EKF based approaches. This is due to the limited measurement and online training schemes utilized to train neural networks. This requires further investigation in hyper-parameter tuning for implementation. Finally, a model-based fault detection scheme was proposed to detect internal thermal fault at its onset. The SOHcoupled model is reformulated to incorporate the internal resistance as a state. The EKF is used as a fault detection observer. The

proposed fault detection scheme is validated using numerical simulation. It was observed that the fault detection scheme with SOH coupled electro-thermal-aging model could effectively detect a thermal fault at its incipient state.
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Dataset description:
This dataset contains 1 file described below.

OCV_Test_Data_26650_Cell.zip:
- OCV_Test_Data_26650_Cell.xlsx
- HPPC_Test_Data_26650_Cell.xlsx
- CC-CV_Charge_Dischage_Data_26650_Cell.xlsx

File Type Descriptions:
- The .xlsx and .xls file types are Microsoft Excel files, which can be opened with Excel, and other free available software, such as OpenRefine.

National Transportation Library (NTL) Curation Note:
As this dataset is preserved in a repository outside U.S. DOT control, as allowed by the U.S. DOT's Public Access Plan (https://ntl.bts.gov/public-access) Section 7.4.2 Data, the NTL staff has performed ***NO*** additional curation actions on this dataset. NTL staff last accessed this dataset at https://digitalcommons.lsu.edu/transet_data/116/ on 2022-05-23. If, in the future, you have trouble accessing this dataset at the host repository, please email NTLDataCurator@dot.gov describing your problem. NTL staff will do its best to assist you at that time.