

Investigation and Estimation of State of Health of Battery Pack in Battery Electric Vehicles-Online Battery Characterization

Authors : Ali Mashayekh, Mahdiye Khorasani, Thomas Weyh

Abstract : The tendency to use the Battery-Electric vehicle (BEV) for the low and medium driving range or even high driving range has been growing more and more. As a result, higher safety, reliability, and durability of the battery pack as a component of electric vehicles, which has a great share of cost and weight of the final product, are the topics to be considered and investigated. Battery aging can be considered as the predominant factor regarding the reliability and durability of BEV. To better understand the aging process, offline battery characterization has been widely used, which is time-consuming and needs very expensive infrastructures. This paper presents the substitute method for the conventional battery characterization methods, which is based on battery Modular Multilevel Management (BM3). According to this Topology, the battery cells can be drained and charged concerning their capacity, which allows varying battery pack structures. Due to the integration of the power electronics, the output voltage of the battery pack is no longer fixed but can be dynamically adjusted in small steps. In other words, each cell can have three different states, namely series, parallel, and bypass in connection with the neighbor cells. With the help of MATLAB/Simulink and by using the BM3 modules, the battery string model is created. This model allows us to switch two cells with the different SoC as parallel, which results in the internal balancing of the cells. But if the parallel switching lasts just for a couple of ms, we can have a perturbation pulse which can stimulate the cells out of the relaxation phase. With the help of modeling the voltage response pulse of the battery, it would be possible to characterize the cell. The Online EIS method, which is discussed in this paper, can be a robust substitute for the conventional battery characterization methods.

Keywords : battery characterization, SoH estimation, RLS, BEV

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