IEEE Access, vol.10, pp.1138-11146, January, 2022.

An online fade capacity estimation of lithium-ion battery using a new health indicator based only on a short period of the charging voltage profile

J.I. Álvarez Monteserín García; M.A. Sanz Bobi

Abstract-

Currently, the most popular health indicator used to assess the degradation of lithium-ion batteries (LIBs) is the State of Health (SoH). This indicator is necessary to ensure the safety, degradation management, and good operation of the battery, for example, the correct estimate of the State of Charge (SoC). In this paper, a new health indicator is proposed as an alternative to the use of the SoH because it has a high correlation and similarity with the SoH and has the advantage that it can be calculated and/or estimated very easily. The new health indicator, named “Degradation Speed Ratio (DSR)” is calculated with variables directly measured (voltage and time), and it is not necessary to spend any time on the total charging cycle, therefore reducing waiting times about 84%. In addition, due to its high correlation with capacity, it is a significant marker of battery end-of-life (EoL). In this study, the obtained DSR and a Gaussian process regression (GPR) model were used to estimate the lost capacity and to compare it with existing models in the literature. The accuracy achieved using the DSR indicator as input is very high. Similarly, the results of a multilayer perceptron neural network (MLPNN) model are shown using the new indicator (DSR) as input to estimate the degradation. The sensitivity and precision of this NN model with unknown data are also very high.

Index Terms- Battery energy storage systems, data-driven estimation, degradation speed ratio, electric vehicles, lithium-ion batteries, model based estimation, state of health, battery energy storage systems.

Citation:
Álvarez-Monteserín, I.; Sanz-Bobi, M.A. "An online fade capacity estimation of lithium-ion battery using a new health indicator based only on a short period of the

charging voltage profile", IEEE Access, vol.10, pp.1138-11146, January, 2022.