Int. J. Electrochem. Sci., 17 **(2022)** Article Number: 220827, doi: 10.20964/2022.08.43

International Journal of
ELECTROCHEMICAL
SCIENCE
www.electrochemsci.org

Efficient estimation method for State of Charge of multi-cell battery pack considering cell inconsistency

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Received: 3 May 2022 / *Accepted:* 9 June 2022 / *Published:* 4 July 2022

State of charge (SOC) is an important state quantity for the normal operation of lithium batteries in electric vehicle. At present, SOC estimation research mainly focuses on single cell, and few papers study the SOC of each cell in the battery pack, which gives the capacity estimation of the battery, and SOH estimation, as well as battery equalization bring technical difficulties and even safety issues. However, it is difficult to conduct the SOC estimation of multiple cells in a battery pack due to the inconsistency, which leads to very complex modeling and algorithms. Aiming at the above problems, this paper proposes a low computational multi-cell SOC estimation method. First, for the series battery pack, the capacity, ohmic resistance and voltage are selected as the inconsistency factors considered in this study, and a battery pack difference model based on the equivalent circuit model (ECM) is established. Then, the model parameters were identified online using recursive least squares with forgetting factors (FFRLS). On this basis, a dual adaptive extended Kalman filter (Dual-AEKF) algorithm is constructed to estimate the SOC of all cells in the series battery pack. Finally, three representative dynamic working conditions are used to verify the SOC estimation accuracy of the proposed method and the robustness of the algorithm. The verification results show that the proposed method can significantly reduce the estimation time on the premise of ensuring the accuracy of cell SOC estimation and the robustness of the algorithm.

Keywords: SOC estimation, Lithium-ion battery pack, Cell inconsistency, Dual-AEKF, Efficient Algorithm

FULL TEXT