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Study on Modeling, Experimentation and State of Charge Estimation of Parallel Connected Lithium-ion Batteries

Xin Huang, Xuning Feng, Xuebing Han, Languang Lu, Minggao Ouyang[*]

State Key Laboratory of Automotive Safety and Energy, Tsinghua University, Beijing 100084, P R China
[*]E-mail: ouymg@mail.tsinghua.edu.cn

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Lithium-ion batteries are always connected in series and parallel to fulfill their functional usage. However, cell variations caused by manufacturing and working conditions can have a great influence on the performance, state of health (SOH), and cell life among the multiple cells in a battery pack. This paper introduces an equivalent circuit model (ECM) for a battery pack composed of several cells connected in parallel. The proposed method simulates current flow distribution among parallel-connected batteries. Meanwhile, a Kalman Filtering algorithm based on the aforementioned ECM is proposed for the state of charge (SOC) estimation of parallel-connected cells. The proposed method has the advantage that very few input variables are needed including only the total current and the total voltage, and the SOC of individual cells can be estimated. The results were validated by experimental data and show good matching accuracy between the model and experimental data. The proposed method provides guidance for additional algorithms that can estimate the individual SOC of cells within a parallel-connected battery pack.

Keywords: lithium-ion battery; parallel-connected; equivalent circuit model; SOC estimation;

FULL TEXT