State of Charge (SOC) Estimation of Lithium-ion Battery Based on Adaptive Square Root Unscented Kalman Filter

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The improved battery management system (BMS) can give full play to the best performance of power battery, and the state of charge (SOC) estimation of power lithium-ion battery is the core and key technology of BMS. The Kalman filter method with the first-order Thevenin model cannot obtain better estimation results because of the limited model precision. Aiming at solving the above problems, this paper presents a second-order Thevenin equivalent circuit model. The idea of the Sage-Husa adaptive algorithm and square root filter is introduced based on the Unscented Kalman Filter (UKF) algorithm. The adaptive square root Unscented Kalman Filter (ASRUKF) algorithm is formed to improve the precision of SOC estimation. Experiments on SOC estimation of the battery are carried out under three different working conditions. The experimental results show that the ASRUKF algorithm under the second-order Thevenin equivalent circuit model can converge quickly and achieve high precision in SOC estimation.

Keywords: lithium-ion battery, SOC estimation, equivalent circuit model, adaptive square root Unscented Kalman Filter

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