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A Novel Joint Estimation Method of State of Charge and State of Health Based on the Strong Tracking-Dual Adaptive Extended Kalman Filter Algorithm for the Electric Vehicle Lithium-Ion Batteries

Ran Xiong[1], *Shunli Wang*[1,*], *Carlos Fernandez*[2], *Chunmei Yu*[1], *Yongcun Fan*[1], *Wen Cao*[1], *Cong Jiang*[1]

[1] School of Information Engineering, Southwest University of Science and Technology, Mianyang 621010, China;
[2] School of Pharmacy and Life Sciences, Robert Gordon University, Aberdeen AB10-7GJ, UK.
[*]E-mail: 497420789@qq.com

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In order to enhance the efficiency of electric vehicle lithium-ion batteries, accurate estimation of the battery state is essential. To solve the problems of system noise statistical uncertainty and battery model inaccuracy when using the extended Kalman filter (EKF) algorithm to estimate the battery state, a novel joint estimation algorithm of SOC and SOH based on the strong tracking-dual adaptive extended Kalman filter (ST-DAEKF) is proposed. Based on the extended Kalman filtering algorithm, the fading factor is introduced into it to enhance the tracking ability. Meanwhile, the adaptive filter which can statistics the characteristics of time-varying noise is used to adjust the noise parameters of the system. The BBDST condition and the DST condition at 25 °C are used for simulation and verification in MATLAB. The results of the algorithm simulation show that under the BBDST condition, the maximum SOC error and the average error of the proposed algorithm are 3.41% and 0.99%, respectively, with the corresponding convergence time of 15 seconds. And under the DST condition, the corresponding data is 1.56%, 1.29%, and 20 seconds, respectively. At the same time, compared with the extended Kalman algorithm, the SOH estimation results of this algorithm also have a better estimation effect and reference value. Under the BBDST condition, the maximum SOH error and average error under this algorithm are 0.12% and 0.06%, with the corresponding data of 0.66% and 0.23% under the DST condition. The above data proves the superiority of the joint estimation algorithm.

Keywords: electric vehicle; lithium-ion batteries; Thevenin; state of charge; state of health; strong tracking-dual adaptive extended Kalman filter

FULL TEXT