Project Description

SOC estimation for Li-ion battery based on Kalman filter algorithm

Motivation

Li-ion battery SOC (State of Charge) estimation is one of the key technologies of electric vehicles, and its accuracy directly affects the vehicle energy management control strategy and the performance of the electric vehicle, which in turn affects the reliability and cost of the vehicle. It is also an important parameter in the battery management system. However, due to the complex electrochemical characteristics of the battery, it exhibits a high degree of nonlinearity during use. The battery SOC state variable cannot be directly measured. It can only be estimated by externally measurable battery terminal voltage, charge and discharge current, etc. Therefore, the SOC estimation of the Li-ion battery needs to establish an appropriate battery model for research. An accurate and appropriate power battery model can effectively reflect the correspondence between the external parameters of the battery and the internal state of the battery, and simplify and specify the SOC estimation problem. It is very important for the simulation, design and optimization of electric vehicles. It can be seen that the establishment of an accurate and simple battery model and accurate battery SOC estimation directly affects the vehicle energy management control strategy and the performance of electric vehicles.

Technical Background

The state space model is based on the battery model to establish the system space expression, and the battery SOC is used as one of the state variables, and battery SOC is estimated through the filter or observer. The main idea is measured current, voltage, temperature and other variables with the battery SOC. these measurables as the input of the model, the error between the predicted terminal voltage output by the model and the actual sampled value of the terminal is obtained. Then multiply the error by the estimated value of the gain feedback the state quantity, so that the estimated value of the state quantity follows the true value. Finally, the current battery SOC value is obtained through the filter.

At present, most experts have used various filtering methods based on Kalman filtering (KF) when performing SOC estimation.

Tasks

- General project management: Definition of work packages, time plan with a Gantt chart and status reports.
- Compelete the SOC estimation of Li-ion batteries using Kalman filtering algorithm.
- Optional: Propose additional tests needed to improve the algorithm.

Requirements

- Basic programming skills (at least one person on the team), preferably writing the required algorithms in Matlab.
- Passion for electric vehicles (or battery management systems, BMS).

Contact

- Supervision: Jinghua Sun, M. Sc.
- E-Mail: jinghua.sun@hswt.de