Impacts of various failure scenarios on the estimation performance of a DKF running on a modular BMS

Abstract:
The main functionalities of a Battery-Management-System (BMS) in a Battery-Electrical-Vehicle (BEV) depend on a reliable state and parameter estimation of each cell. For example, an efficient balancing requires an accurate State-Of-Charge (SOC) calculation of each cell, and the power prediction is based on precise internal resistance estimation. A previous paper [1] showed an accurate way of estimation using a Dual-Kalman-Filter (DKF) [3] [4] [5] and a simple battery model [2]. It also reveals that wrong initial values or imprecise measurement can cause a divergence of this algorithm. In a real environment of the BMS there are several possibilities to bring the related filter to an unstable behaviour. The aim of this paper is to analyse the filter behaviour based on variation of critical scenarios. The detection of these influences and the protection of the algorithm are important investigations of the paper at hand. The main goal is to provide the detection of failure scenarios in the battery system like an internal cell short circuit or the disconnection of a cell based on the changes in the estimated states and parameters. In those critical scenarios it is desirable to know the exact behaviour of the algorithm to differ between real failures in the battery system and failures in the algorithm computing process.

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