

Integration of on-board EIS into foxBMS

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In order to extend the lifespan of a battery, it is important to know the evolution of its capacity and impedance as a function of operating conditions. Electrochemical Impedance Spectroscopy (EIS) can be used for this purpose. Consequently, the Battery Management System (BMS) can operate the battery in the best way. With this work, the aim is to make the data required to model the battery constantly accessible to a BMS, based on the open source foxBMS.

Introduction

Nowadays, batteries play a key role in a multitude of applications and their demand is constantly growing. It is therefore important to be able to extend their lifetime. The State of Health (SoH) of a battery depends on several factors related to its utilisation. The BMS monitors the conditions under which the battery is operating and ensures that they are ideal. This is done by the BMS representing the battery through an Equivalent Circuit Model (ECM). Keeping the ECM updated over time allows the degradation of the battery to be taken into account and thus optimise its use. Electrochemical Impedance Spectroscopy can provide the value of the internal impedance of the cell measured at different frequencies. By analysing the EIS measurements, it is possible to determine the components of the Equivalent Circuit Model.

Goals

The project can be divided into three different areas and main objectives:

- Develop a PCB in order to interface the measuring circuit with the BMS
- Implement communication between the measuring device and the BMS
- Analyse the measurement data to constantly keep the ECM updated

Methods

In the context of a previous project, a circuit for EIS measurements for portable applications was established and provided the starting point. Furthermore, the use of an external microcontroller was necessary

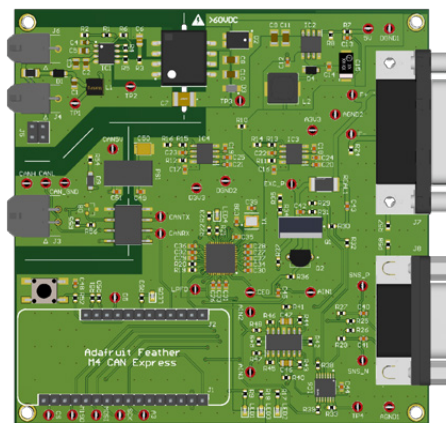
to interface and control the measurement circuit with the foxBMS. Consequently, a printed circuit board was developed with the necessary circuits and connections. Once the code to manage the measurement process was implemented, in order to verify the quality of the results, comparative measurements were made with a laboratory instrument. The last step was to have a function to extract the data needed to update the ECM and transmit them to the foxBMS.



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Result and conclusion

A device for EIS measurements ready to be used with a BMS is available. Nevertheless, it is still a prototype and further analyses must be carried out before moving on to the next stage.



Resulting 10x10 cm PCB which represents the EIS board

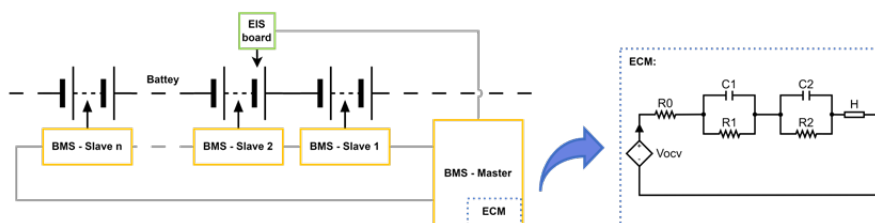


Diagram of a possible application of this project: monitoring a cell of the battery system