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ETAS Entwicklungs- und
Applikationswerkzeuge für
elektronische Systeme GmbH

Borsigstraße 14
70469 Stuttgart, Germany
Phone +49 711 89661-240
Fax +49 711 89661-108

Press and Public Relations:
Anja Krahl

anja.krahl@etas.com
www.etas.com

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Press Release

Putting a Virtual Power Source to the Acid Test

With all its complexity, the battery management system (BMS) comprises one of the key components breathing life into the electric powertrain. It influences vehicle range, performance, and ride comfort. It follows that a comprehensive system test is an indispensable prerequisite for the stable operation of a battery management system under all possible conditions.

Conducting a comprehensive battery of tests on real-life batteries would present a multitude of limitations. For example, changing a battery's state of charge (SOC) is a time intensive endeavor that not only burdens the battery's cells but also consumes large quantities of energy. Plus, tests considering aging effects – besides being even more time consuming – are also difficult to reproduce. And finally, with real-world batteries, it is practically impossible to run tests of critical operating conditions or acquire the parameter values for all cell variants – both weak and strong – within a given battery module or power pack. Many borderline or worst-case scenarios either elude direct control or involve a substantial hazard potential.

In view of the foregoing, Hardware-in-the-Loop (HiL) testing systems play an important role in the development of battery management systems. In this way, testing under a variety of conditions can be carried out in a safe and efficient fashion.

In the majority of instances, when testing the controller functions, the emulation of individual cells can be dispensed with. The functions can instead be simulated at the signal level by means of the ETAS LABCAR-RTPC, with the results forwarded via the bus directly to the BMS to be tested. These signal-level tests are an ideal and cost-effective way of covering many functions without the need for special hardware. The prerequisite for reliable results is a real-time capable battery model that possesses high accuracy and performance, and that also facilitates state-of-the-art balancing methods that include an assessment of the charge status (SOC) not only of individual cells but also of entire cell clusters.

ETAS now offers a real-time capable battery simulation model that meets all of these demands. This Simulink®-based simulation model contains, aside from the comprehensive cell model, also a logic module for controlling virtual cell supervisory controllers (CSCs), which can be used in the model for the simulation of balancing currents. The number of series-connected cells can be selected as needed. Working with the PC-based RTPC, a 120-cell battery pack that is commonly used in automotive applications can be calculated within approx. 50 µs (Intel® Core 2 Quad Q9400; 4 x 2.66 GHz).

The new simulation model is also capable of mapping the cell voltage dynamics while charging or discharging a battery pack with a variety of currents. The properties of single cells in the pack can be individually set without affecting calculation time. It is also possible to map thermodynamic effects and a power loss model.

With its new battery model, the powerful LABCAR HiL system for BMS provides numerous options for the efficient testing of new vehicle propulsion systems at both cell and signal levels.

ETAS

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As a dependable and responsible partner, we offer a comprehensive product portfolio of integrated tools and solutions designed to increase quality and efficiency in the development and maintenance of embedded systems. Our tools are widely deployed in automotive and adjacent segments of the embedded industry.

The product portfolio is complemented by engineering services, consulting, training, and first-class customer service. We are an active contributor to standardization committees such as ASAM, OSEK, Nexus, AUTOSAR, AESAS, FlexRay, LIN, and JasPar.

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