Desarrollo de un sistema de gestión de baterías utilizando Simulink

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Motivation

Collaboration

Short Iteration Cycles

Safety Critical System
What is BMS?

Software

- Supervisory tasks
- SOC estimation
- Contactor management
- Isolation monitoring
- Fault detection and recovery
- Thermal Management
- Current & Power Limits

Electronics

- Block Voltage, Temperature Measurement
- Cell Diagnostic
- Cell Balancing

Battery Pack

- Demo
- 3

MATLAB EXPO 2019
Start with Simulation
Battery Cell ↔ Large Battery Pack

Cell Dynamics

Thermal Model
Develop & Test Algorithms in Simulink
Generate C/C++ Code From BMS Algorithm Models
Perform HIL Testing for BMS ECUs

Testing ECUs with Battery Cells
- Longer test cycles
- Difficult to reproduce results
- Limited test automation
- Difficult to test fault conditions
Perform HIL Testing for BMS ECUs

Automatic Code Generation

Wiring and Signal Conditioning

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Perform HIL Testing for BMS ECUs

IO991: Battery Emulation I/O Module

Key Features:
- 6 independent isolated channels
- Architecture allows series & parallel combinations
- Independent power and sense lines
- Voltage range of 0-7 V with 14-bit resolution
- 300 mA source to load
- 100 mA sink adjustable in 16 steps

Enables:
- Test automation and repeatable testing
- Fault testing safely
- Reuse testcases from earlier desktop testing
Summary

Multi-Domain

Collaborate Across Domains

Long Iteration Cycles

Reduce Iteration Time

Safety Critical System

Functional Safety Certification
Taking It Further

Parameter Estimation

Test Automation

HDL Code Generation

Model Checks

Design Error Detection

Model Coverage
Learn More about Battery Management System

WHITE PAPER

Developing Battery Management Systems with Simulink and Model-Based Design

https://www.mathworks.com/discovery/battery-models.html

Battery Modeling

Model batteries when designing battery-powered systems

Technical Articles and Newsletters

Modeling and Simulating Battery Performance for Design Optimization

By Cecilia Wang, Romeo Power

Battery Modeling

Examples and How To
- Battery Management System Development in Simulink (7:17) - Video
- Lithium Battery Model with Thermal Effects for System-Level Analysis (24:55) - Video
- Automating Battery Model Parameter Estimation using Experimental Data (25:28) - Video
- Real-Time Simulation of Battery Packs Using Multicore Computers (22:57) - Video
- Battery Simulation and Controls - Consulting Services
- Sifting Through Multisource Data for Safer Battery Materials with Machine Learning - Article

Papers
- High Fidelity Electrical Model with Thermal Dependence for Characterization and Simulation of High Power Lithium Battery Cells - IEEE 2012
- Battery Model Parameter Estimation Using a Layered Technique - SAE 2013
- Simplified Extended Kalman Filter Observer for Battery SOC Estimation - SAE 2013
- Battery Pack Modeling, Simulation, and Deployment on a Multicore Real Time Target - SAE 2014
- Model-Based Parameter Identification of Healthy and Aged Li-ion Batteries for Electric Vehicle Applications - SAE 2015