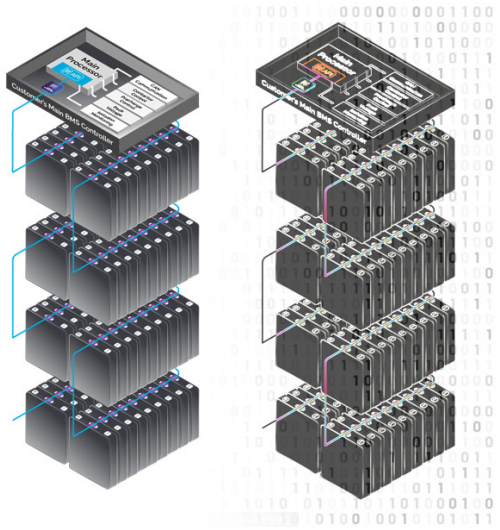
Create better battery digital twins with cell-level intelligence

DUKOSI BLOG | Published: 8 Nov 2024

A digital battery twin is a virtual model that replicates the behavior and characteristics of a physical battery. It leverages real cell data from end applications, such as arrays of lab cells or in-field batteries, and applies advanced modeling and computing to generate a virtual real-time representation of the actual battery pack, allowing a deeper understanding of performance versus usage.



This operational technology is revolutionizing how existing batteries are being used through more insightful State of Health (SoH) calculations, while also identifying potential failure patterns that can be flagged for predictive maintenance to ensure warranty commitments and safety goals are maintained. Recording more accurate SoH also benefits circular economy efforts by improving reuse opportunities, as trusted SoH data increases battery value.

Importance of in-field data

Creating an accurate digital twin requires a model factoring in both performance and thermal behaviors of the battery cells. This means sourcing information from each cell's electrical behavior, inference of internal electrochemical processes, and temperature sensors throughout the battery that evaluate how it reacts to the external environment and its own heat generated from use or charging.

In-field data is the only way to accurately accrue the diverse environments and usage profiles experienced by cells over their lifetime. This data, when paired with a digital twin, provides the requisite information to allow companies to offer the highest quality products, extended lifetime and long warranties to ensure customer confidence.

Ultimately, these learnings also build intelligence towards next-generation batteries, infusing them with improvements to current designs, enhanced performance and safety, and longevity, which ultimately reduces long-term costs.

Making every cell intelligent

Dukosi's innovative chip-on-cell technology can enhance raw data gathering by extracting more data points from each battery. The Dukosi Cell Monitoring System (DKCMS) includes Cell Monitors that collect extremely accurate, synchronous, on-cell measurements, process the data, and send it to the BMS main processor (Host) via the DKCMS System Hub. By placing a Cell Monitor with an embedded temperature sensor on each cell, and with the potential for two additional thermistors, the system amplifies the data gathered in every battery to create much more accurate thermal models. Compared to just 12-16 temperature capture points in a typical 96-cell battery pack, DKCMS can make up to 288 temperature readings, generating an unprecedented degree of insight.

As the Cell Monitors are typically placed closer to the cell terminals with minimal, and consistent sense lead lengths, they record highly accurate voltage data. Dukosi C-SynQ® communicates data through a unique near field network with deterministic latency which ensures no disparity in readings, especially when the battery experiences sudden voltage transients, such as during acceleration, again improving data accuracy.

With more accurate, more detailed and larger battery data sets, DKCMS allows companies to build more accurate models and ultimately better digital twins, putting them a step ahead of competitors when assessing and managing existing products and developing next-generation battery designs.

Dukosi Ltd develops revolutionary technologies that dramatically improve the performance, safety, and efficiency of battery systems, and enable a more sustainable battery value chain. The company provides a unique cell monitoring solution based on chip-on-cell technology and C-SynQ® communication protocol for electric vehicles (EV), industrial transportation and stationary battery energy storage markets.

For more information, email info@dukosi.com or visit www.dukosi.com.