Digital Intelligent Battery Technology

SOLAR PRO.

What is a digital twin battery?

Digital twins (DTs) of batteries utilize advanced multi-layer models, artificial intelligence, advanced sensing units, Internet-of-Things technologies, and cloud computing techniques to provide a virtual live representation of the real battery system (the physical twin) to improve the performance, safety, and cost-effectiveness.

Can digital twins of batteries be used to develop intelligent management systems?

Digital twins of batteries can be used to develop multi-scale intelligent management systems. In addition,there are challenges such as the need for multiphysics models,nano-/microscale characterization,and low-latency communication networks. Additionally,effective data pre-processing and increased data security must also be considered.

What is intelligent control of a battery system?

Intelligent control of a battery system leverages off a battery management system(BMS) which is able to sense its environment,understand its current/future state and thus be able to adapt.

What makes an intelligent battery system?

Data: on-board sensing and diagnostics A critical element of an intelligent battery system is what data can be collected about the systemand what information can be inferred from its analysis. Furthermore,as ML approaches become increasingly applied,the quality and diversity of data vectors becomes a critical enabler.

Are battery digital twins a multi-disciplinary physical system?

As a multi-disciplinary physical system,battery digital twins play a transformative role in multi-scale design and intelligent management system of battery systems. The proposed complex physical battery digital system can be continuously updated using knowledge generated from data of both known and unknown physics.

What are the benefits of a digital twin battery system?

Compared with onboard BMSs,digital twin for battery systems has potential benefits in four aspects as follows,which all together contribute to the reduction of the total cost of ownership and the increase of system performance:

neering is the use of digital twins technology to achieve intelligent battery management [17]. The models used for battery digital twins can have different accuracy and compu-tational complexity. The high-fidelity[18] models can simulate the real battery process with ...

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Intelligent Telecom Energy Storage Drawing on an insight into future network evolution, and leveraging battery technology, network communications, power electronics, ...

The battery management system (BMS) is vital to the battery lifespan, reliability and safety [12]. It is an intelligent control unit that integrates several functional modules, and contains various types of sensors and actuators. ... the digital twin opens the way for efficient development of battery management technology. Digital twin ...

One such novel technology is based on the digital twining of battery systems. Digital twins (DTs) of batteries utilize advanced multi-layer models, artificial intelligence, advanced sensing units ...

We focus on modeling, diagnostics, prognostics, and optimal control for complex electrochemical energy storage devices using digital and artificial intelligence tools, in applications ranging ...

Firstly, this paper arranges the development history, basic concepts and key technologies of the digital twin, and summarizes current research methods and challenges in battery modeling, state estimation, ...

Furthermore, based on digital twin we describe the solutions for battery digital modeling, real-time state estimation, dynamic charging control, dynamic thermal management, and dynamic ...

AI in EV battery technology can help address these issues. Adopting ML for EV battery R& D, BMS and range optimisation offer several benefits over traditional methods. They improve EV performance, safety, ...

The performance of cloud computing is critical for deploying cloud-based digital twin technology in battery diagnostics. Cloud platforms provide robust computational capabilities and enable the storage and processing of large data volumes, which are crucial in battery diagnostics and management [116, 117],. In this field, cloud computing allows ...

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