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Quanscient Allsolve for electric vehicle battery pack development

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Faster product development and time-to-market

Battery packs include a wide range of design parameters such as geometry, cell types, cooling approaches, materials, and interfaces. Physical prototypes remain costly and slow to produce, which limits iteration speed.

Simulation enables the reduction of costly and slow prototyping. It shows possible weak points in early stages when changes are still cheap, and it helps testing and optimizing the design already before any physical manufacturing takes place.

This shortens the development timeline, saving in prototypes, and leads to a quicker launch and better competitive position

Product quality, performance and safety

The battery pack is one of the most expensive and sensitive part of an electric vehicle, and its performance directly affects reliability.

Simulation of the battery pack contributes to effective thermal management, thermomechanical durability, more uniform ageing, higher energy efficiency, predictable performance, and lower thermal runaway likelihood

These improvements reduce warranty issues, decrease risk, extend battery lifetime, and support stronger overall profitability.

Cost optimization across the entire lifecycle

Simulation can guide decisions related to cell choice, pack structure, packing density, materials, cooling systems, and BMS or charging profiles. It also generates data for warranty and lifetime estimates, degradation and lifecycle assessment, and supply chain planning. Even small changes in performance, mass, or lifetime influence the full cost structure of an electric vehicle.

This leads to lower production costs, stronger margins, and improved long-term economics.



What makes Quanscient Allsolve unique?

Battery pack thermal performance is a demanding multiphysics challenge where several interacting physical effects must be considered together to achieve reliable results.

Quanscient Allsolve is a fully coupled multiphysics simulation tool designed for cloud-scale workloads, using methods and quantum-ready algorithms that enable extensive parallelization of battery-related physics.

This approach allows engineers to interactively explore new design options, iterate rapidly with direct feedback, evaluate thousands of scenarios, and run detailed lifecycle studies.

Cell thermal behaviour and lifecycle simulation

Selecting the appropriate cell type is essential, as different cells present different thermal and electrical characteristics. Parameters such as thermal capacity, conductivity, internal resistance, and heat generation must be known.

Quanscient collaborates with cell model experts, such as **Batemo** for high-fidelity battery cell models, and organizations can also use their own battery research. Together with accurate cell data, Allsolve's multiphysics approach enables reliable ageing prediction, often based on ageing models that include an Arrhenius-type temperature dependency.

This makes the simulation suitable for warranty and lifetime estimates, such as calculating years or kilometers before the state of health reaches a defined level.

Module and pack structure optimization

Key structural considerations include packing density, cooling channels, and intermediate materials. Pure 0D or 1D models become insufficient for large packs or uneven cooling conditions, where temperature differences cause uneven ageing and imbalance.

Local hot spots accelerate degradation and can escalate if left unaddressed. The pack structure strongly affects hot-spot formation, and Quanscient Allsolve supports the evaluation of thermal stresses and mechanical fatigue to improve durability and reliability.

Electrical load and drive/usage profiles

Simulation includes various drive and charging conditions such as rapid acceleration, repeated peak loads, DC fast charging, and regenerative braking. The duty cycle has a significant influence on temperature development, and accurate ageing prediction requires understanding real operating patterns.

Quanscient Allsolve provides insight into cold-start behaviour and enables analysis across a wide range of real-world scenarios. This makes Quanscient Allsolve as an ideal companion when designing innovative products that deliver reliable performance under specific operating conditions.

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