

IAV Barito

Calibration of Battery Models

Modern batteries for electric and hybrid vehicles have to meet stringent requirements on various parameters. Very high charge and discharge currents have to be accommodated while CARB certification necessitates ultra-precise SOC calculation. And the race for the highest electric cruising range has only just begun. Calculating these parameters requires in-depth knowledge of chemical mechanisms and the performance of sensors.

IAV works mainly with model-based control to achieve superior functionality. Cell behavior is modeled at different levels and validated using comprehensive test scenarios on the test bench. Varying technical issues result in a wide variety of model approaches. Equivalent circuit models are important for typical SOC and SOH algorithms as well as real-time implementation with control units that have a wide operating range. More complex CFD multiphysics models are needed for critical states when it comes to calculating electric current release or optimizing thermal systems. Thermal and electric behavior is calculated in 3D for specific dynamic load scenarios such as fast charging at high system temperature. Even more details are required when cell design is optimized in collaboration with the manufacturer. Tradeoffs between capacity and power or mechanical robustness are necessary when calibrating specific parameters. The design and understanding can be enhanced by electrochemical simulations that show interdependencies when varying process and material parameters within a specific cell. By integrating our comprehensive range of expertise, we can achieve better results in system design, control strategy, energy management and performance measures for your battery system.

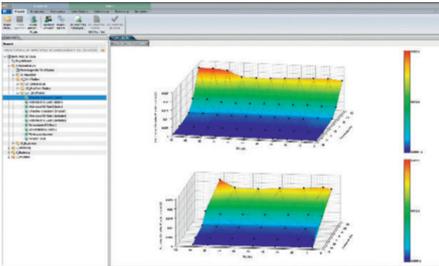
IAV's integrated approach

From concept to validation, IAV is committed to accomplishing all the development steps that ensure robust algorithms. IAV's experienced team takes care of time-consuming data processing, ensuring that our algorithms work in Arctic and desert regions.

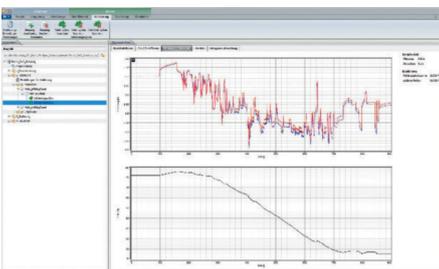


Product by IAV

Tool-Based Battery Model Evaluation



It takes just seconds to pre-process test bench data and compute datasets



Quality measurements for models used in model-based control algorithms



Validation tests performed on IAV's state-of-the-art test benches

Calibrating battery models for control units is a complex and time-consuming process – until now: IAV can offer a new development tool that systematically guides the user through all work steps. The IAV Barito software complements IAV's tools for developing electrified powertrains.

In an initial step, IAV Barito pre-processes the data from the test bench. The current and voltage of the cells or batteries are measured in relation to temperature and state of charge (SOC), producing high-resolution measurement readings and therefore very large quantities of data. The software checks these data for plausibility to avoid further interference when extracting parameters. It also segments the values measured – with individual ranges being selected for identifying parameter sets. Once this has been completed, the user has to configure the electric equivalent circuit diagram of the battery model. IAV Barito permits any number of RC circuits whose time constants can be specified as well. It is also possible to define the dependence of current direction as well as different open-circuit voltage maps – together with optional aging investigations, for instance. In addition, the user can set the maximum value range for model parameters, which is very useful for parameterizing software that is related to control units.

As soon as the measurement readings have been pre-processed and the model parameters are defined, the software can start its main task. At the press of a button it matches the resistances and time constants in the model to the data measured. An optimization algorithm has been adapted specifically for this task. A matching job like this used to take several hours – the new tool delivers its results on a regular PC in just under one minute. Typically the batch routine will generate the datasets for requisite SOC and temperature matrices.

The program then evaluates the quality of the computed model parameters. To validate them, it uses data measured independently, for example during an actual driving cycle of a test vehicle equipped with the same cell type. Model quality is only sufficient if measured values and computed values match up within certain limits. Customized validation cycles can be used to evaluate model quality. Parameterized with the tool, battery models can be transferred to battery management systems, CFD software or vehicle-longitudinal simulation.

IAV invites you to experience firsthand the performance of IAV Barito. You can download a free trial version of the software. Do not hesitate to get in contact our support team, we ensure you get the user experience you expect. We look forward to receiving your feedback. Please follow the QR code below to start your personal download.

