

Synthetic Modeling of Batteries – a Case Study

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Abstract

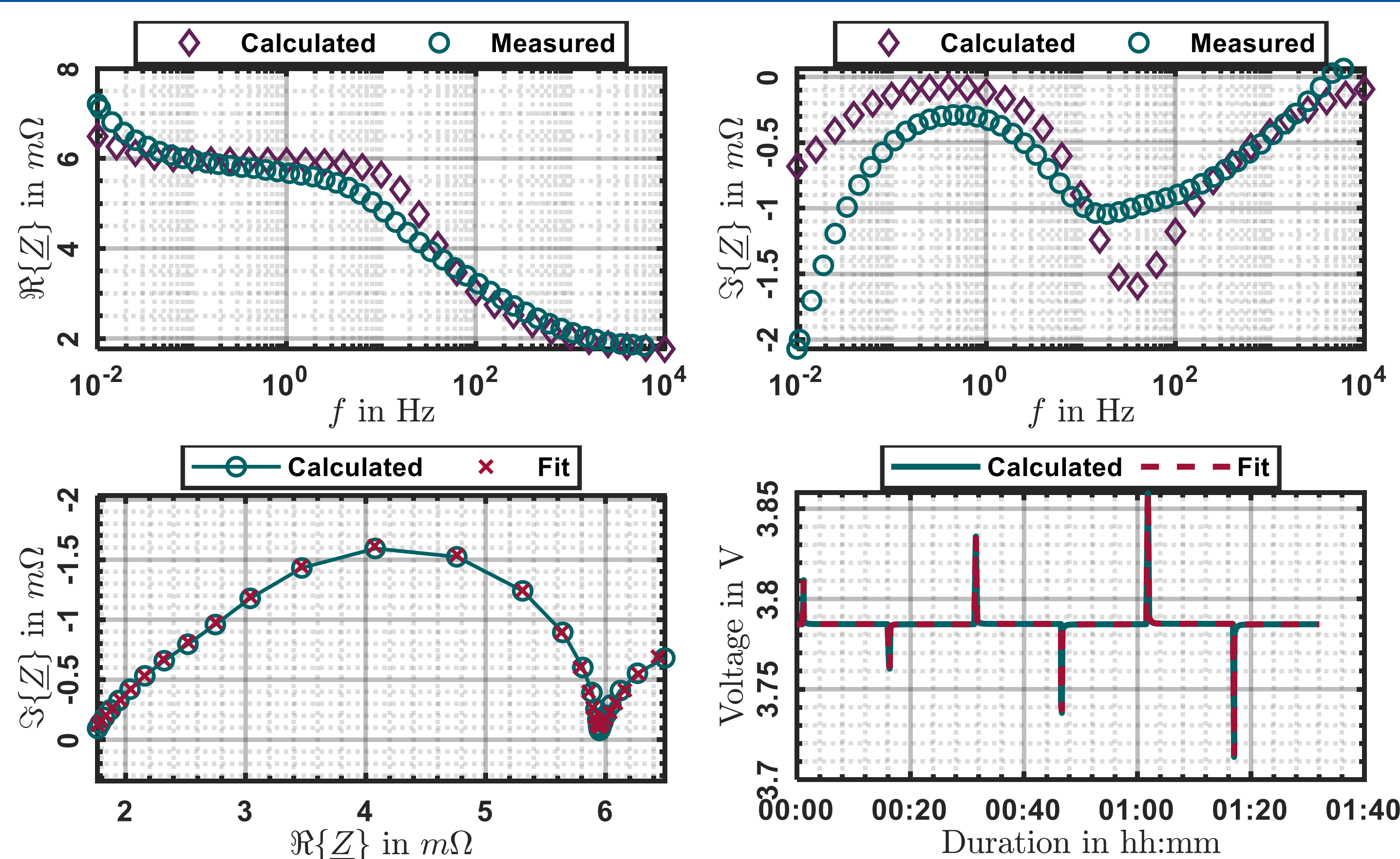
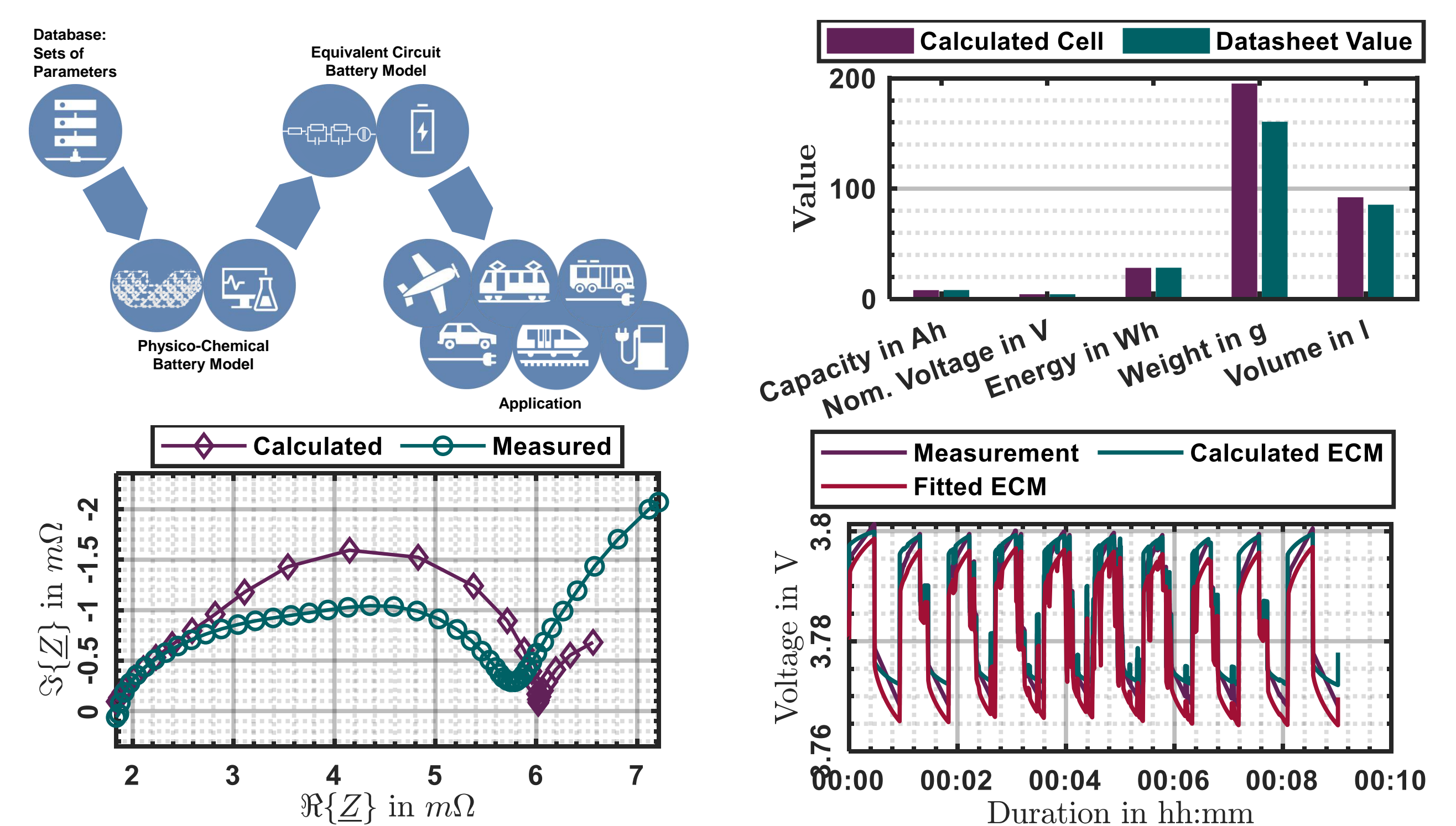
Upcoming battery materials are frequently published in the scientific literature as active materials. Due to a prototype cell's time- and money-intensive construction process, it is advantageous to do an initial approximation on a simulative basis. Therefore we developed the "Synthetic Battery Modeling Toolchain" (*SBMT*).

Conclusion

With the *SBMT*, we can parameterize electrical impedance-based models from physico-chemical simulations, parameterized by virtually designed battery cells. The models can accelerate the design process, pre-filter the cell or cell material selection, characterize novel materials before prototypes of such cells are available and shorten innovation cycles.

Structure

- Database structure inspired by the real-world production process of battery cells
- From chemical elements over all intermediate products of the production process to the cell
- Corresponding parameters are calculated
- Parameters are used to do physico-chemical battery simulations for our automated parameter identification process

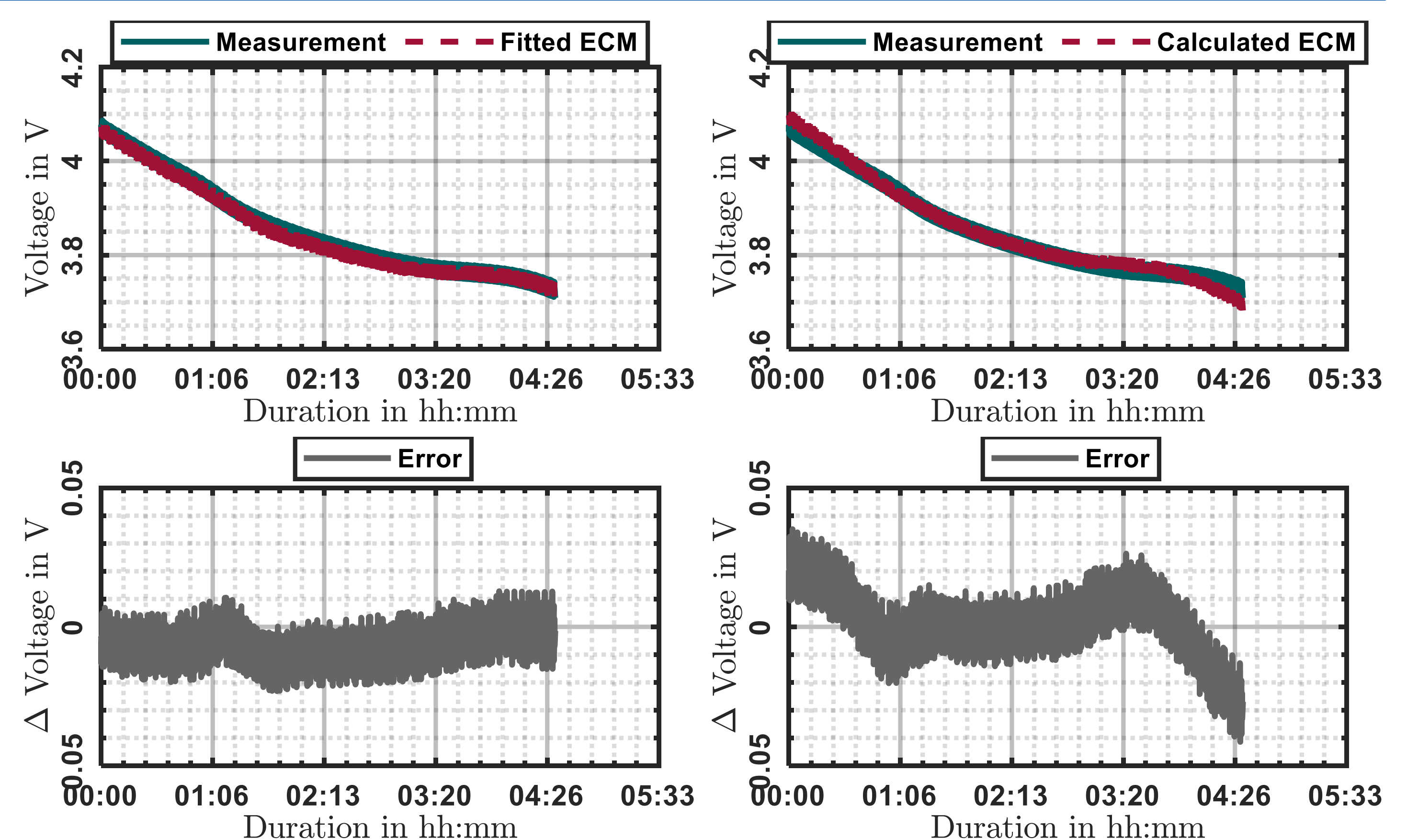


Parameterization

- Hybrid parameterization both, in frequency and time domain
- Performed for calculated data from the tool-chain and from real-world measurement
- Same model for both cases
- Initial verification to be sure no parameterization error occurred
- Least square fitting parameters of the transfer function and the measurement/calculation

Validation

- Measurements on the real cell with two synthetic battery load profiles
- Comparison between simulation and measurements for both, ECM parameterized with calculated and measured input
- Calculation of the error is shown over time
- In the medium SOC area (20% to 80%) our calculated ECM has errors of the same magnitude as the one using measurements.



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