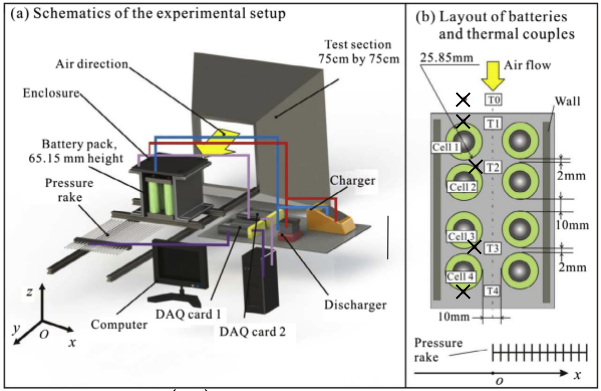
Numerical Simulation Applied to the Cooling of Li-ion cells for Electric Vehicles

Computational Fluid Dynamics and Heat Transfer, Uncertainty Quantification Methods

Supervisors : Héloïse BEAUGENDRE, Pietro CONGEDO

Simulation of the Li-ion cells cooling

Experiment reproduction with CFD



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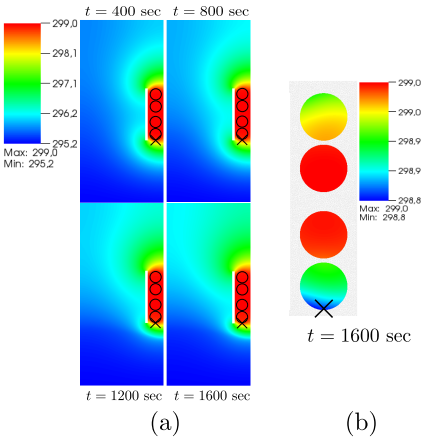

FIGURE – 2D Simulation of conjugate heat transfer - Run on PlaFRIM

Simulation of the Li-ion cells cooling

Experiment reproduction with CFD

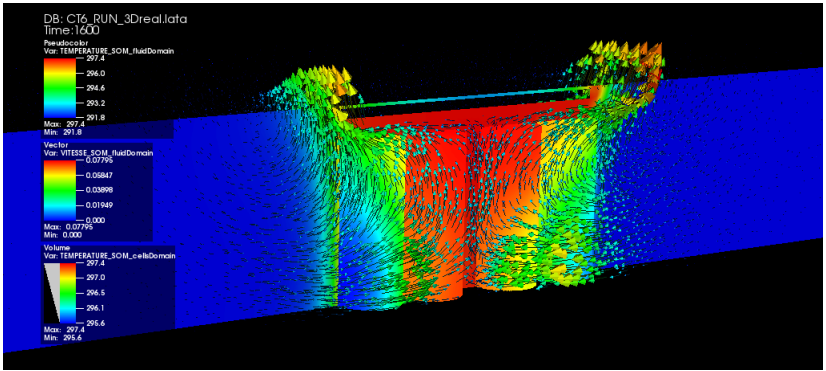

FIGURE – 3D Simulation of conjugate heat transfer - Run on PlaFRIM

Simulation of the Li-ion cells cooling

Experiment reproduction with CFD

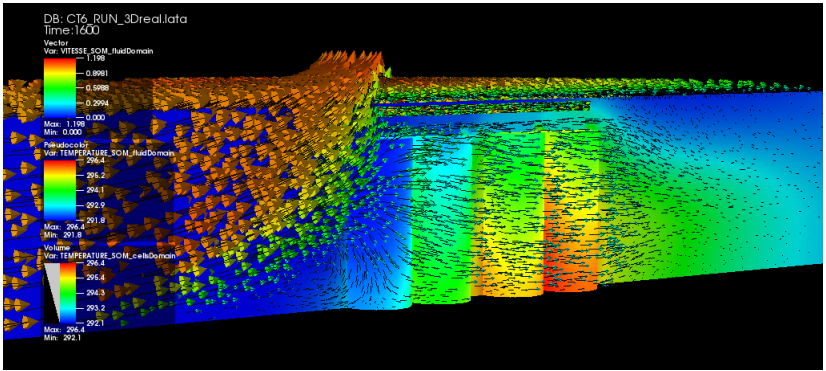

FIGURE – 3D Simulation of conjugate heat transfer with inlet velocity- Run on PlaFRIM

Uncertainty Quantification

Taking into account uncertainties inherent to input physical parameters

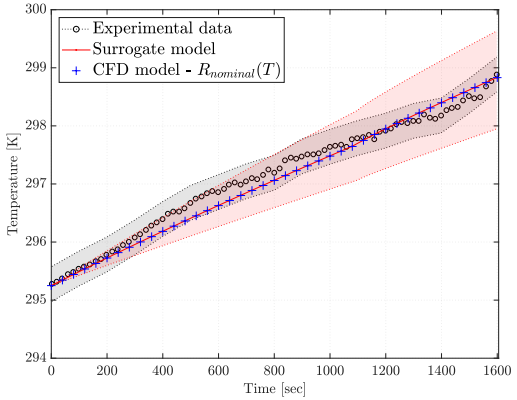

FIGURE — Response comparison of CFD model and Machine Learning based surrogate model. Comparison with experimental data and envelopes due to uncertainties. Construction of the surrogate model requires numerous simulations of the CFD model.

Bayesian Calibration of uncertain parameters

Calibration of input parameters with experimental data

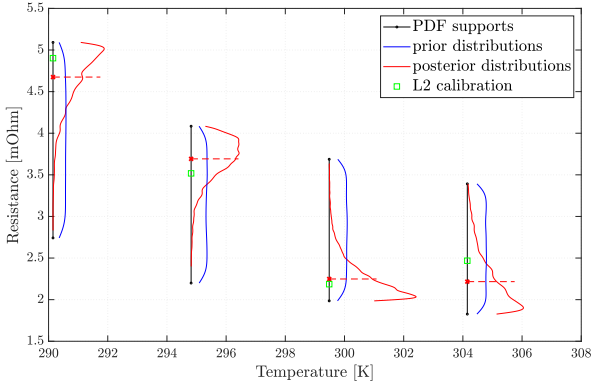

FIGURE – Bayesian calibration of uncertain parameters with respect to experimental data

Bayesian Calibration of uncertain parameters

Calibration of input parameters with experimental data

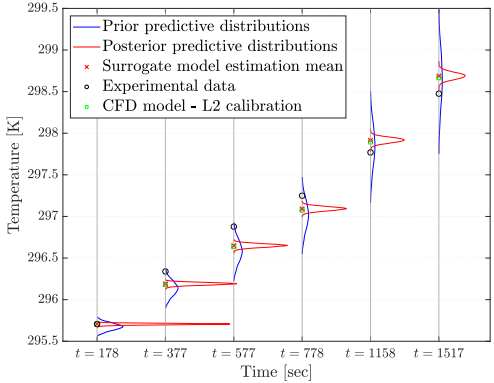

FIGURE – Forward propagation of calibrated distributions, reducing the uncertainty coming from the CFD model.

Partnerships and interactions

Work in partnership with CEA Saclay for the CFD code - TrioCFD.

Apply this kind of methodology to industrial applications with Exoes.