

YOSHIKAWA LAB.

Hydrogen Tank Driving Carbon Neutral Society



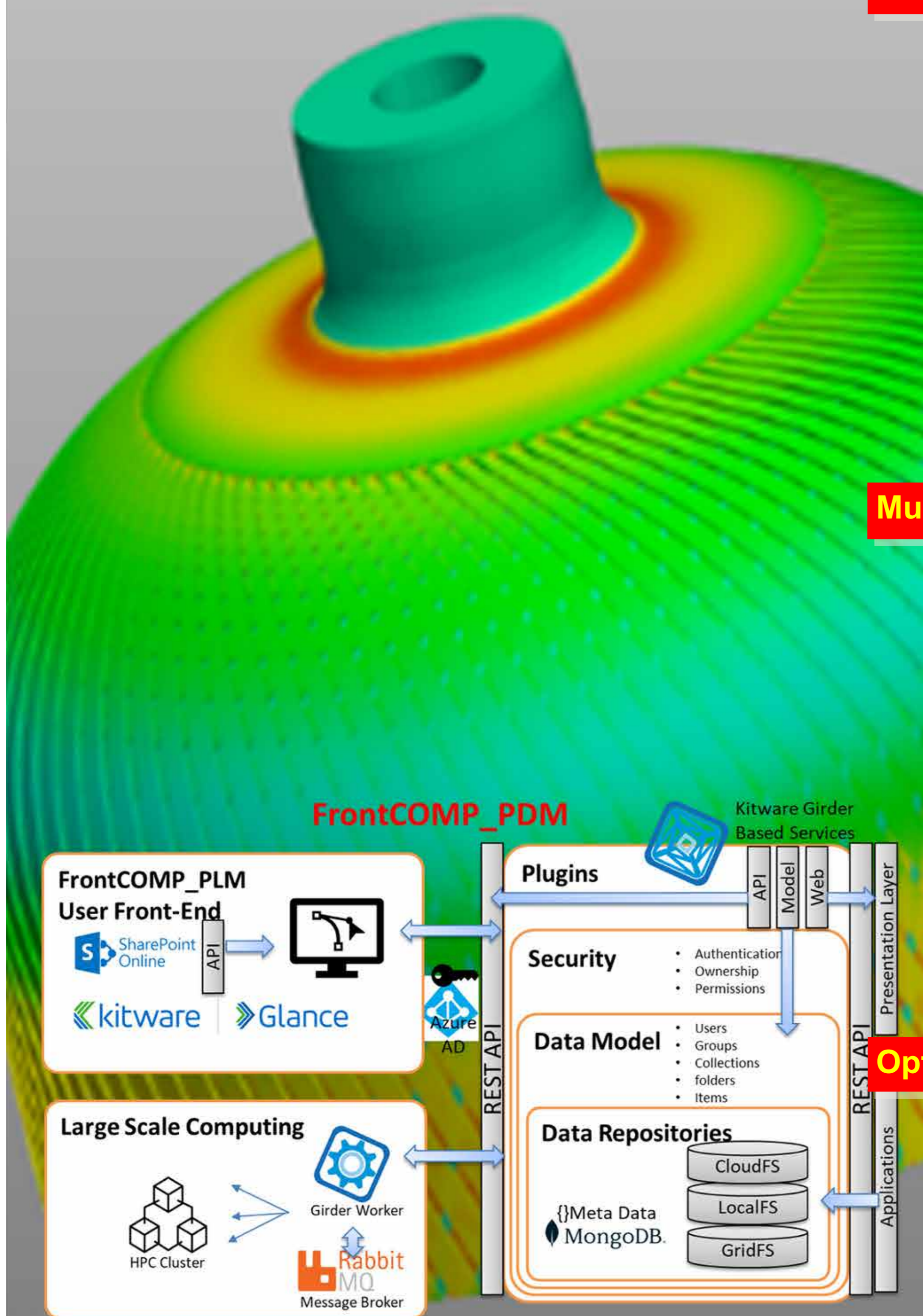
Center for Research on Innovative Simulation Software

Multi-scale Solid Mechanics

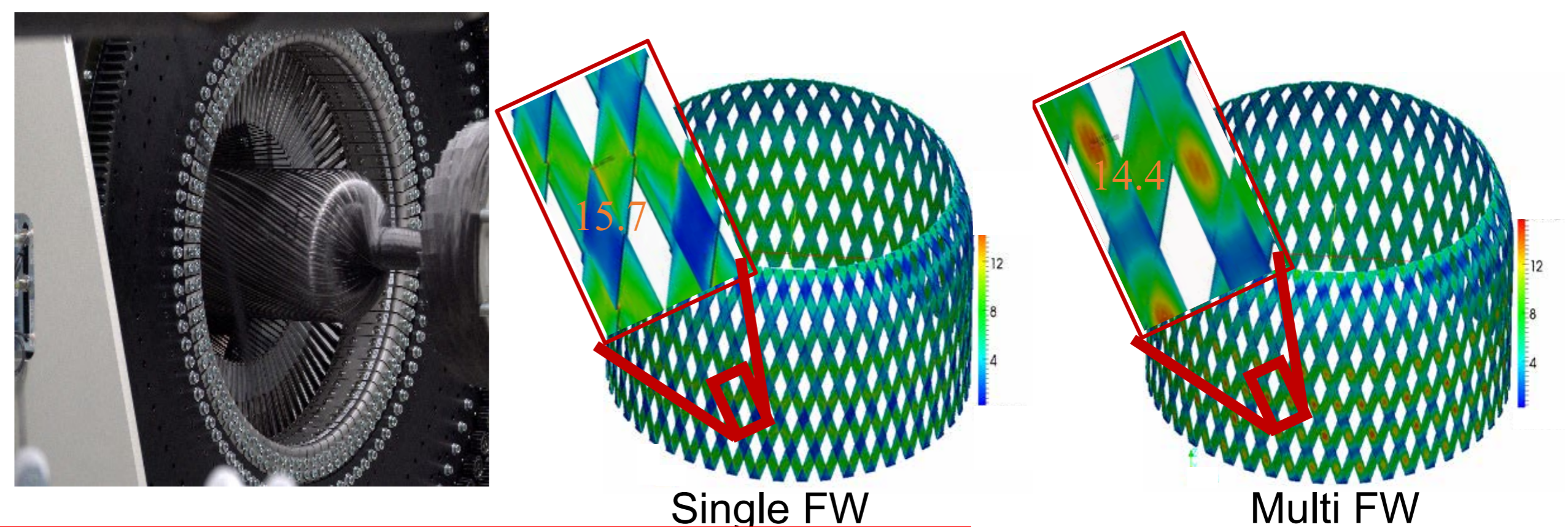
Department of Mechanical Engineering, Graduate School of Engineering

<http://www.young.iis.u-tokyo.ac.jp>

FrontCOMP Advanced Simulation Software to Support Design and Production of CFRP Pressure Vessels

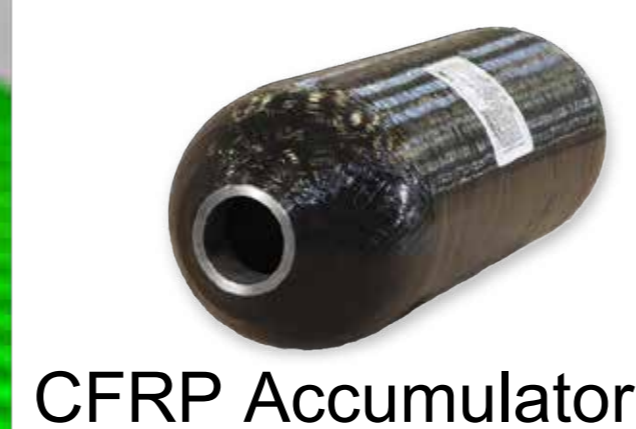


An advantage of multi filament winding (FW) verified based on meso-scale CFRP model

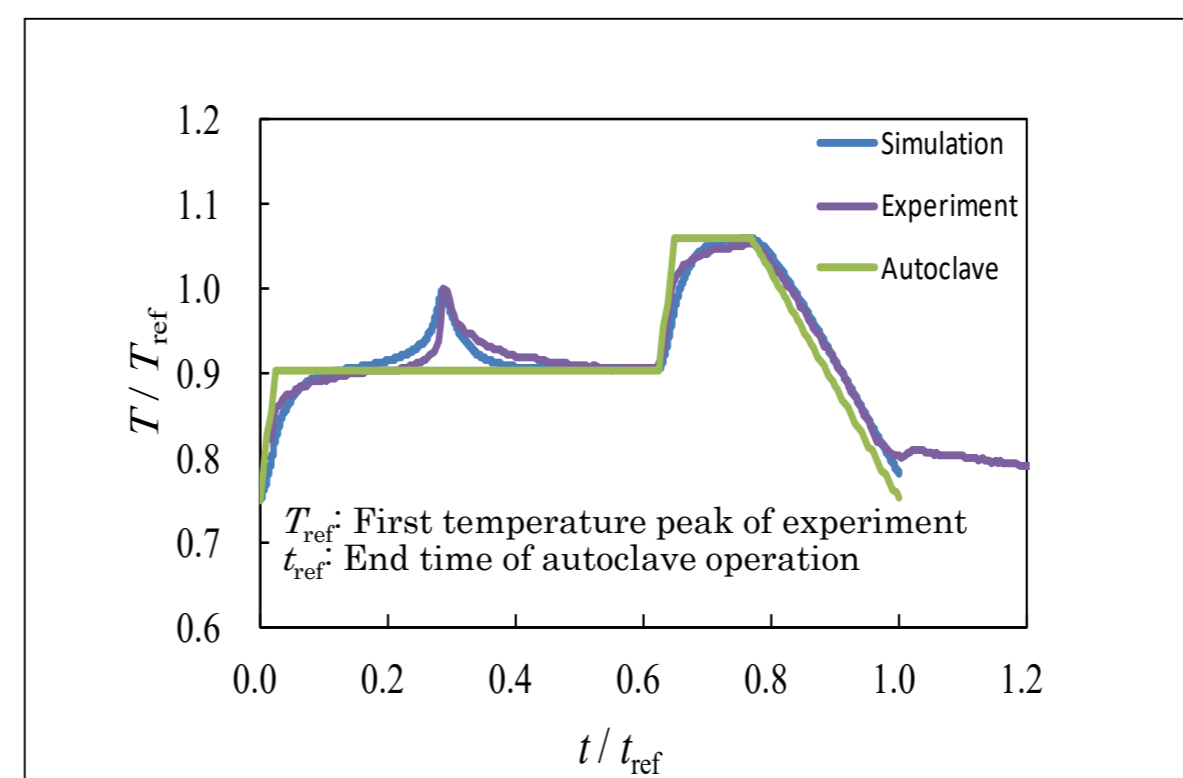


Optimization of Curing Process of CFRP Pressure Vessel

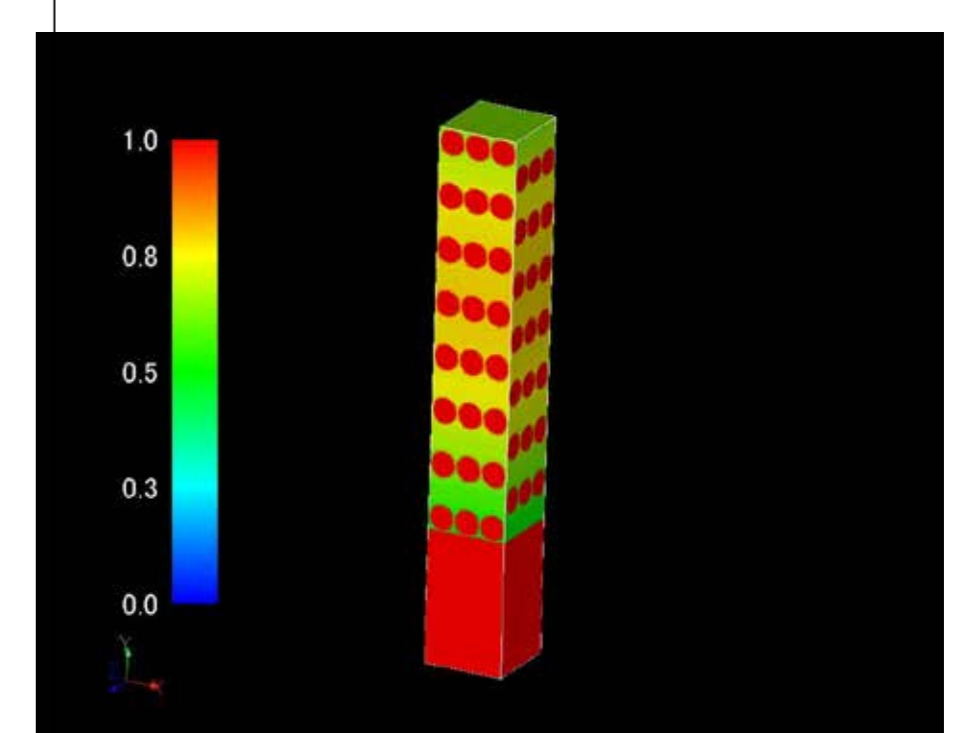
Evaluation of thermal spike in CFRP accumulators to guarantee reliability for long life



CFRP Accumulator

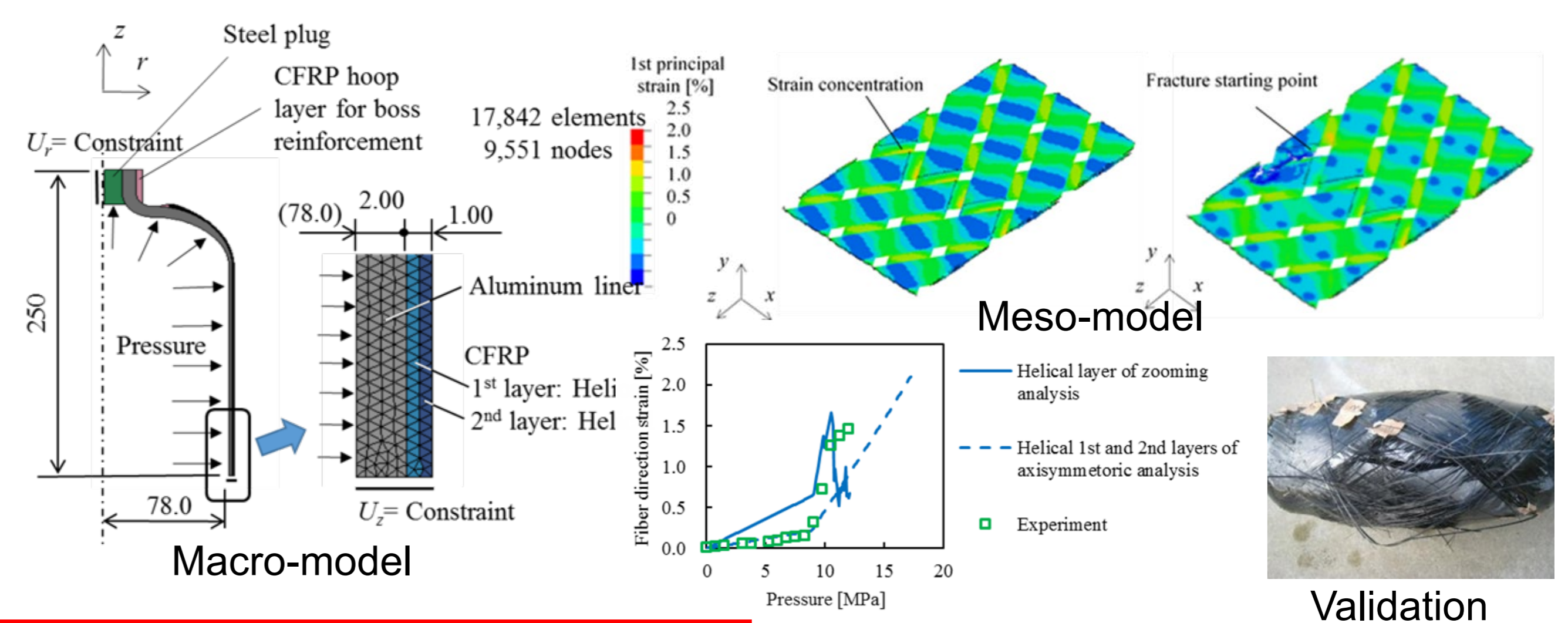


Thermal Spike of CFRP Surface



Degree of Cure

Multi-scale Simulation for Burst Pressure Prediction of CFRP Pressure Vessel



Validation

Optimization of CFRP Pressure Vessel by AI

Optimum Design AI Engine

Design Parameter

- Carbon Fiber
- Resin
- Burst Pressure
- Internal Volume
- Space Efficiency

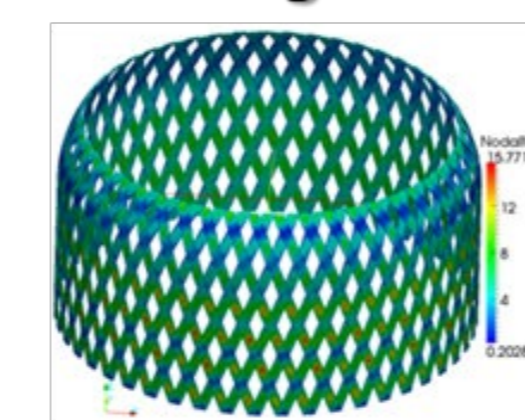
Machine Learning Model



Optimum Design

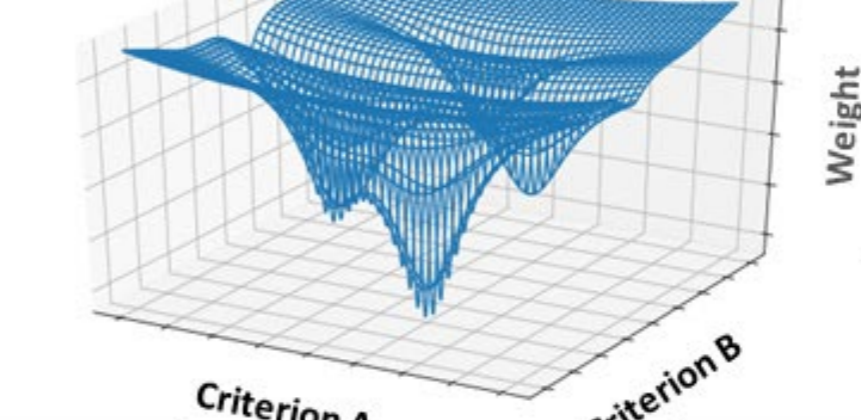
- Shape
- Dimensions
- CFRP Layers Arrangement

HP Simulations for Learning Data



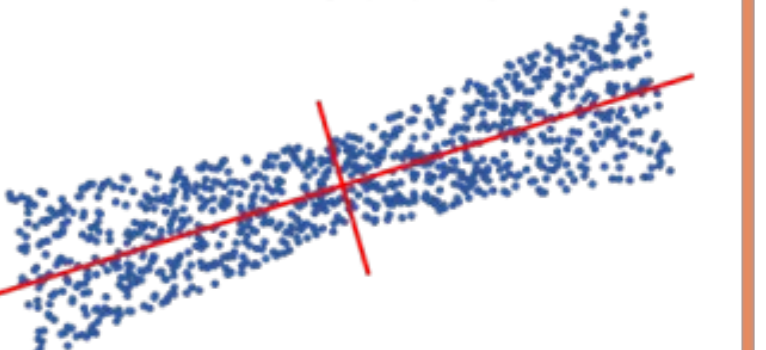
FrontCOMP_wind

Optimum Design Search



Optimum Design Search

Machine Learning Module



Principal Component Analysis

Digital Data Processor for FW Pressure Vessel

- FrontCOMP_tank: Axisymmetric continuum model
- FrontCOMP_FW: Single-FW meso-model
- FrontCOMP_FW_multi: Multi-FW meso-model
- FrontCOMP_FW_shell: Multi-FW meso-model by shell
- FrontCOMP_wind_multi: CAM data for Multi-FW

Forming Simulation of CFRP

- FrontCOMP_cure: Thermoset CFRP
- FrontCOMP_TP: Thermoplastic CFRP

