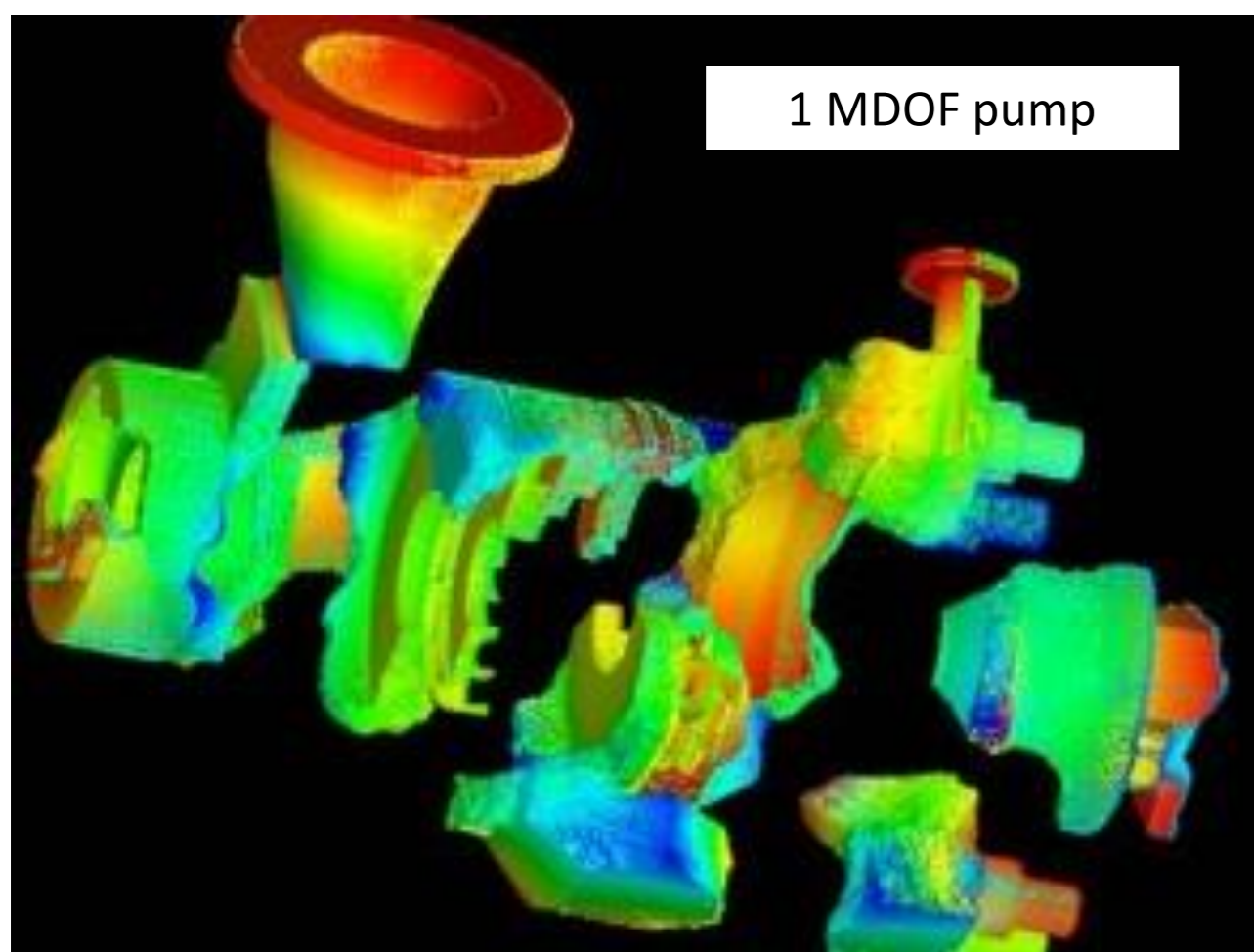# Nonlinear Structural Analysis System
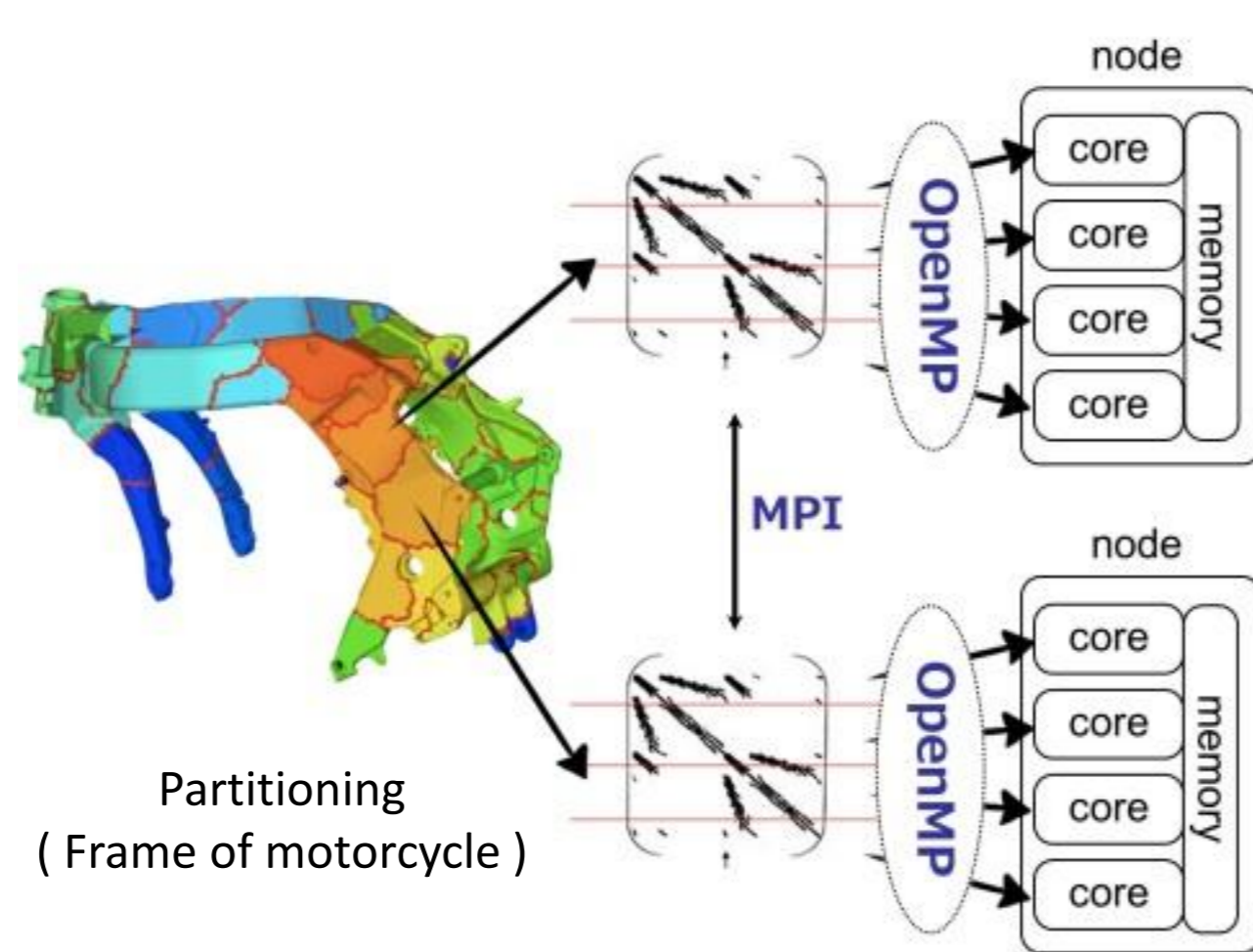
FrontISTR / HEC-MW

Licence — Freeware
MIT License
Operating environment
Windows, Linux

FrontISTR is an open-source structural analysis system, which runs on PCs and parallel supercomputers such as the K computer. A dedicated Pre/Post processor is included in the system. Supporting fruitful nonlinear analysis functions comparable to those of commercial codes, FrontISTR also exhibits an innovative aspect that addresses large-scale application, parallelism, and programmability. A 7.5 billion DOF problem can be solved in 13.7 h using 65,536 cores of "K."
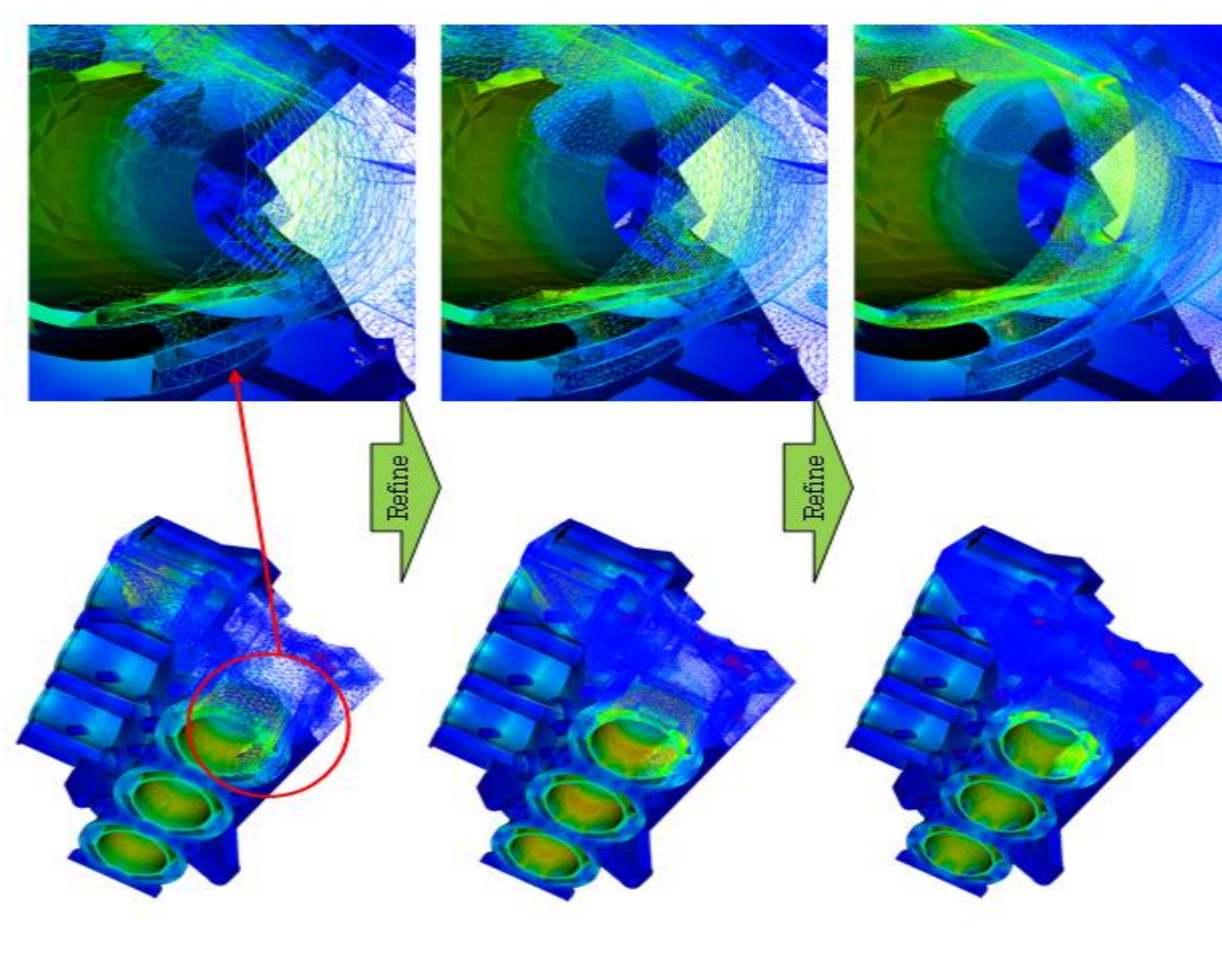
Large-scale Parallel Analysis

1 MDOF pump

node
core
core
memory
core

OpenMP

MPI

node
core
core
memory
core

OpenMP

Partitioning
(Frame of motorcycle)

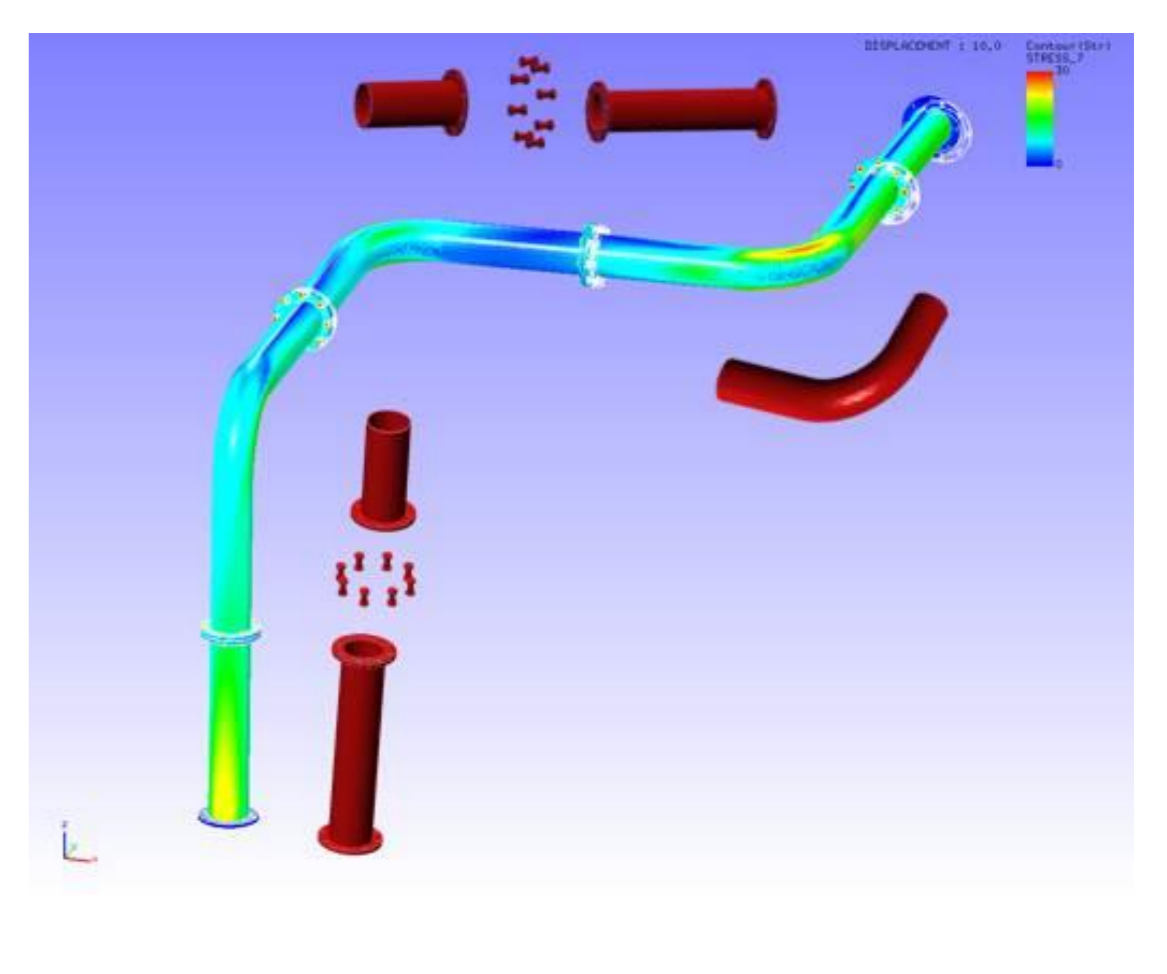**Domain decomposition for parallel computing**

MPI-OpenMP hybrid parallel
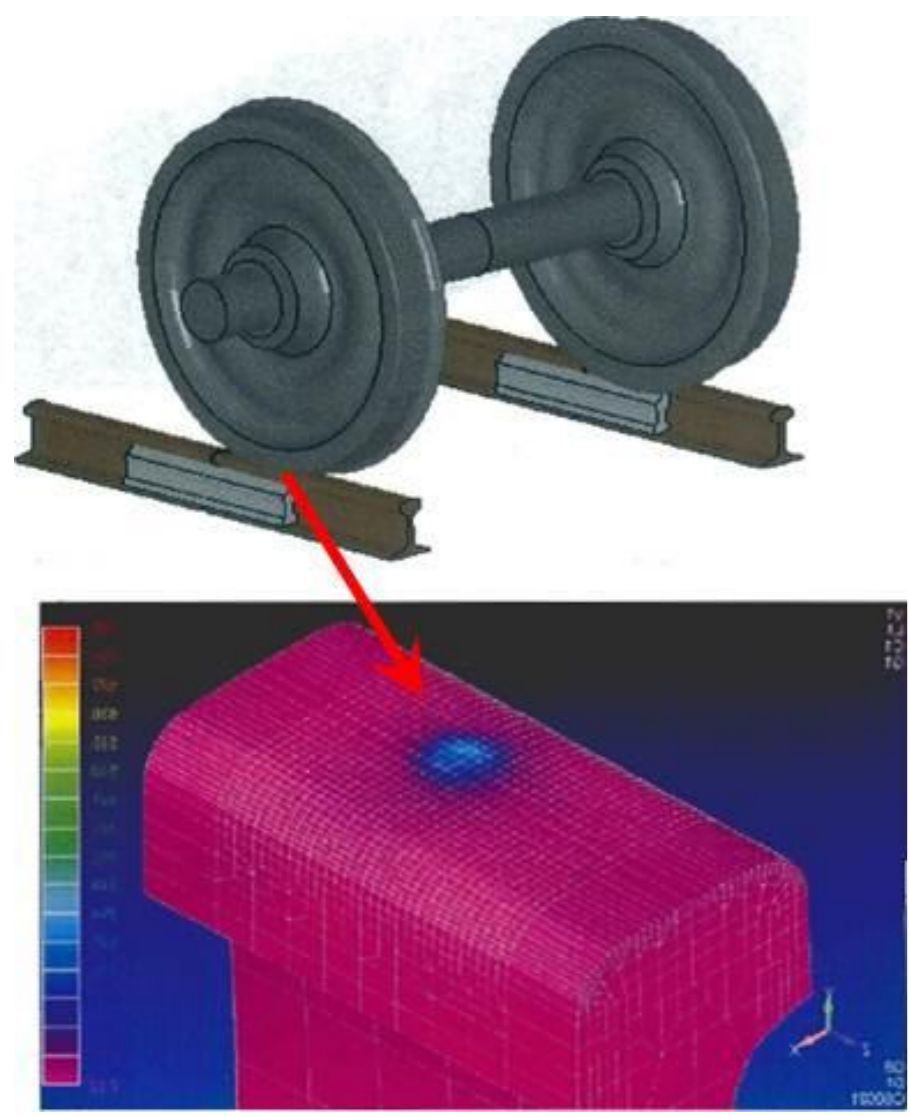
Detailed Assemble Structure

Analysis aided by 'Refiner' (Thermal stress analysis of engine block)
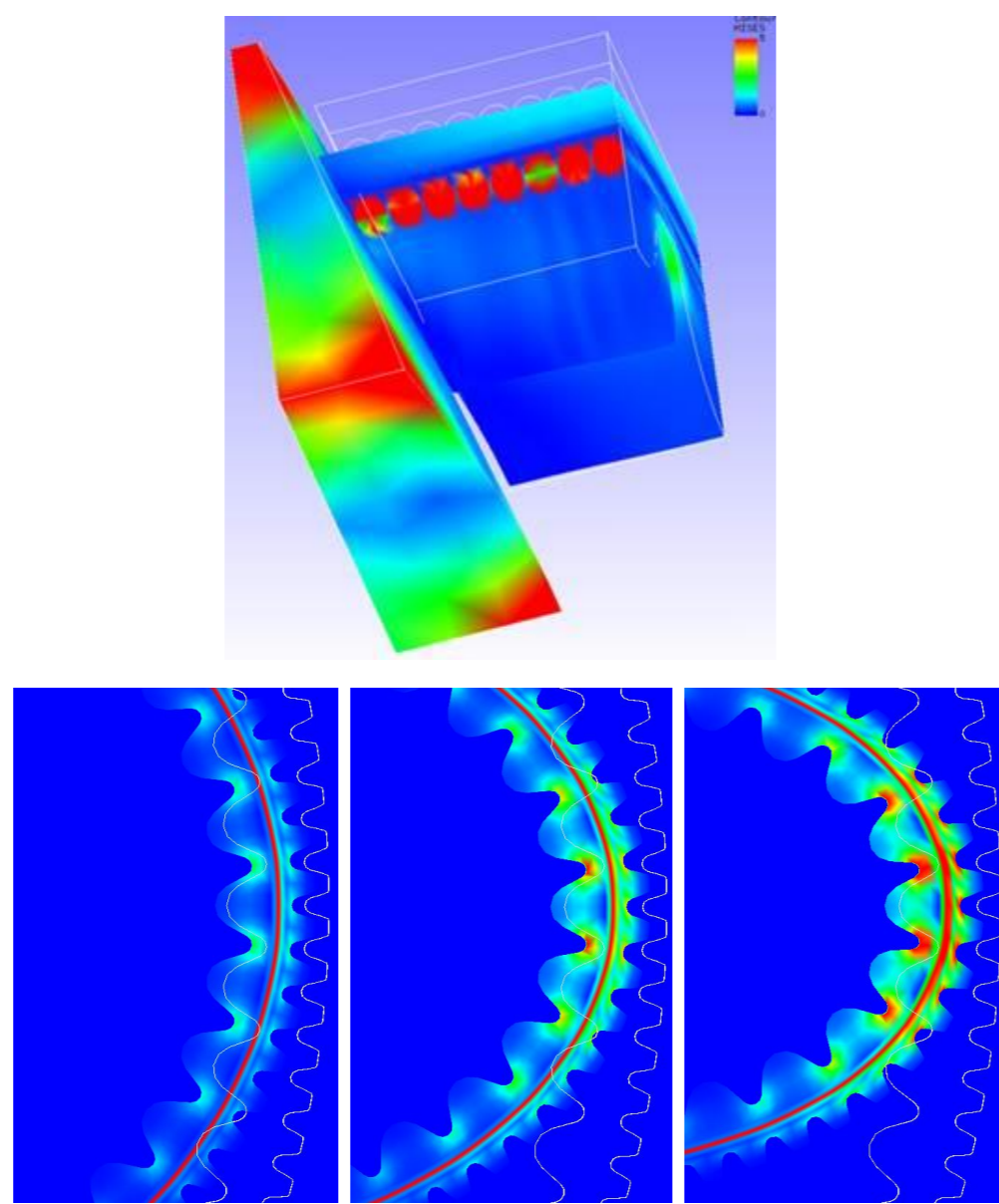
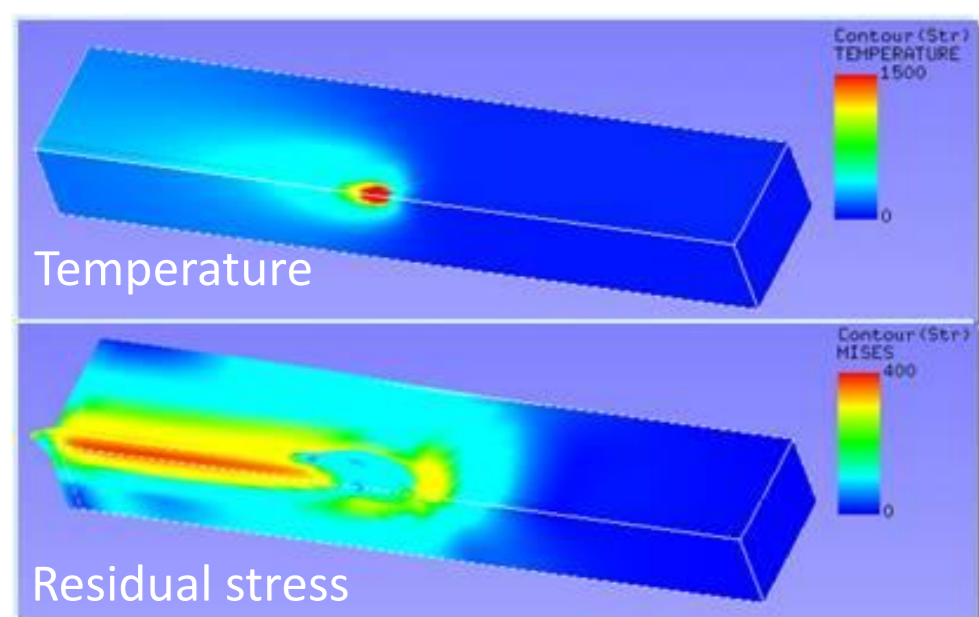**Assemble of parts (Stress analysis of piping system composed of many parts)**
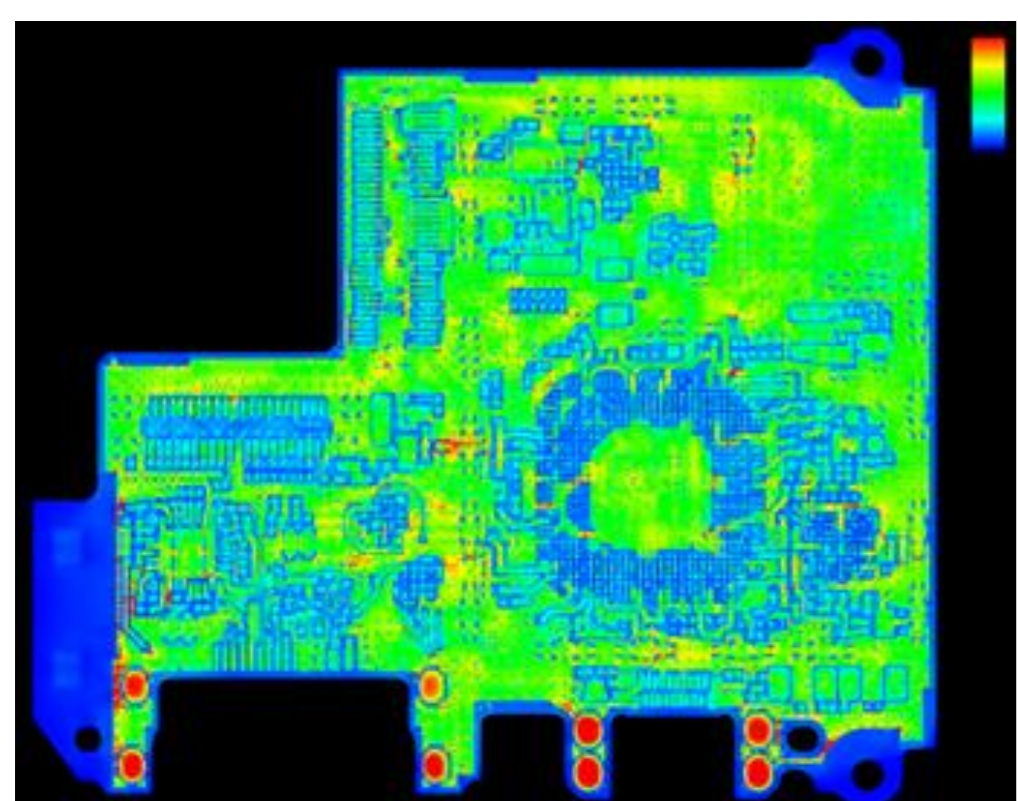
Industrial Applications

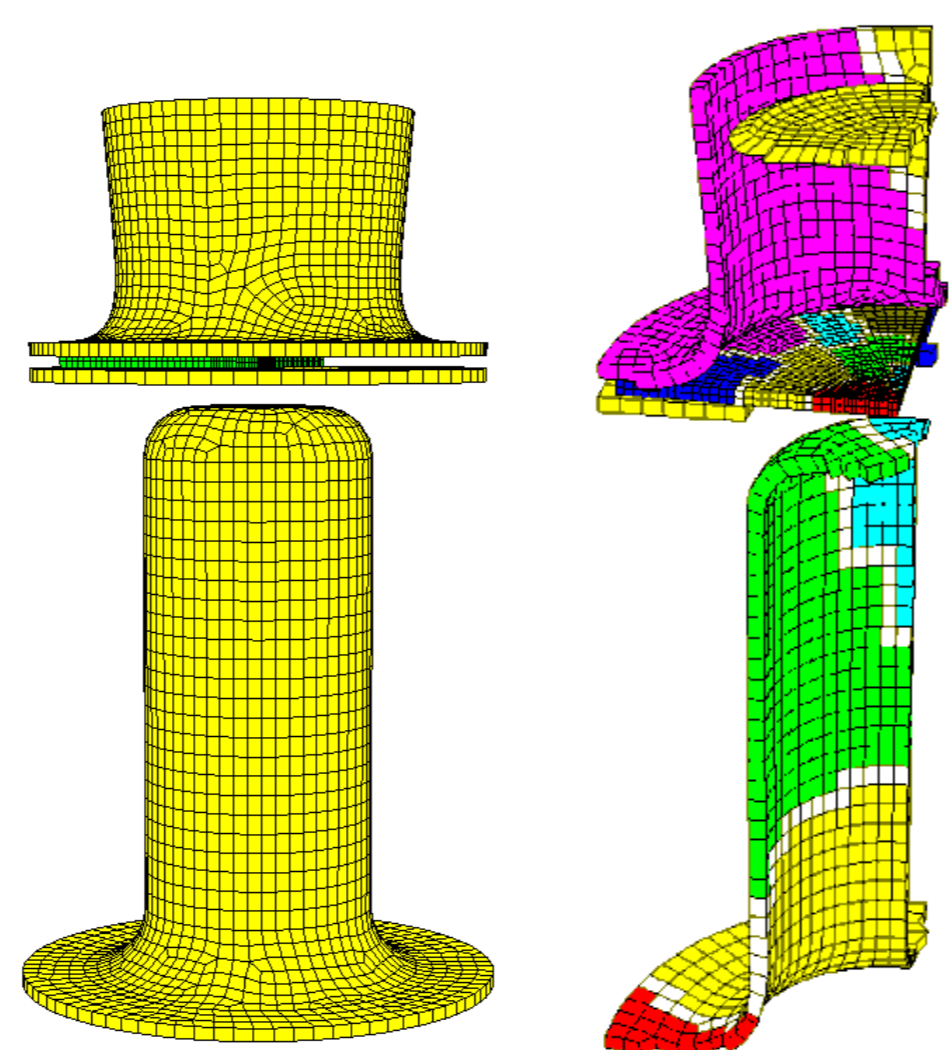**Rolling contact between fast running train's rail and wheel**

Frictional power transmission belt

Temperature

Residual stress

Thermal-elastic-plastic analysis of welding residual stress
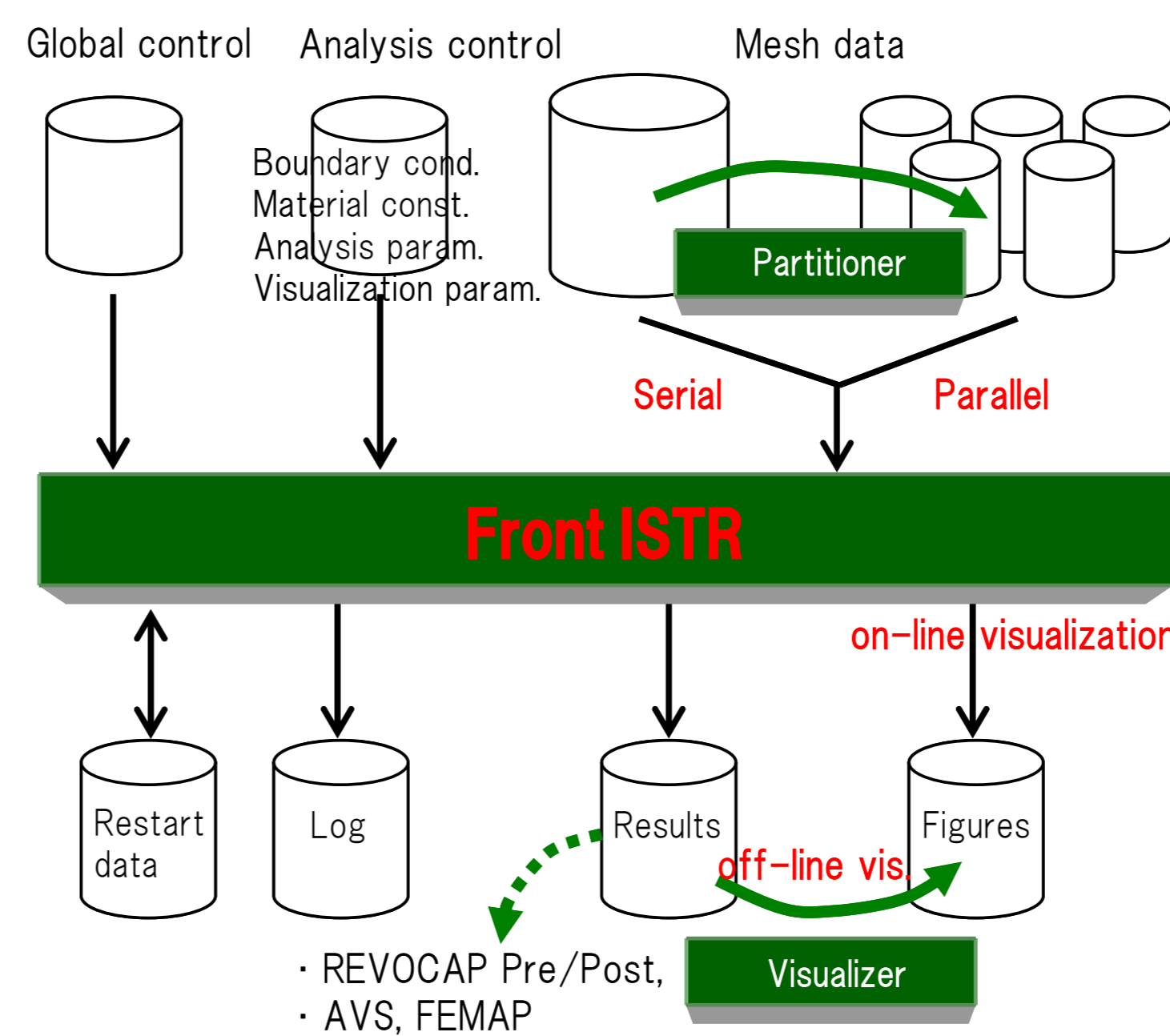
Cupping press simulation

Thermal bending analysis of printed-circuit board(Mises sress distribution)
(DOF: 7.5 billion, Minimum mesh size: 7.5 micrometer, Number of cores("K computer"):65,536)
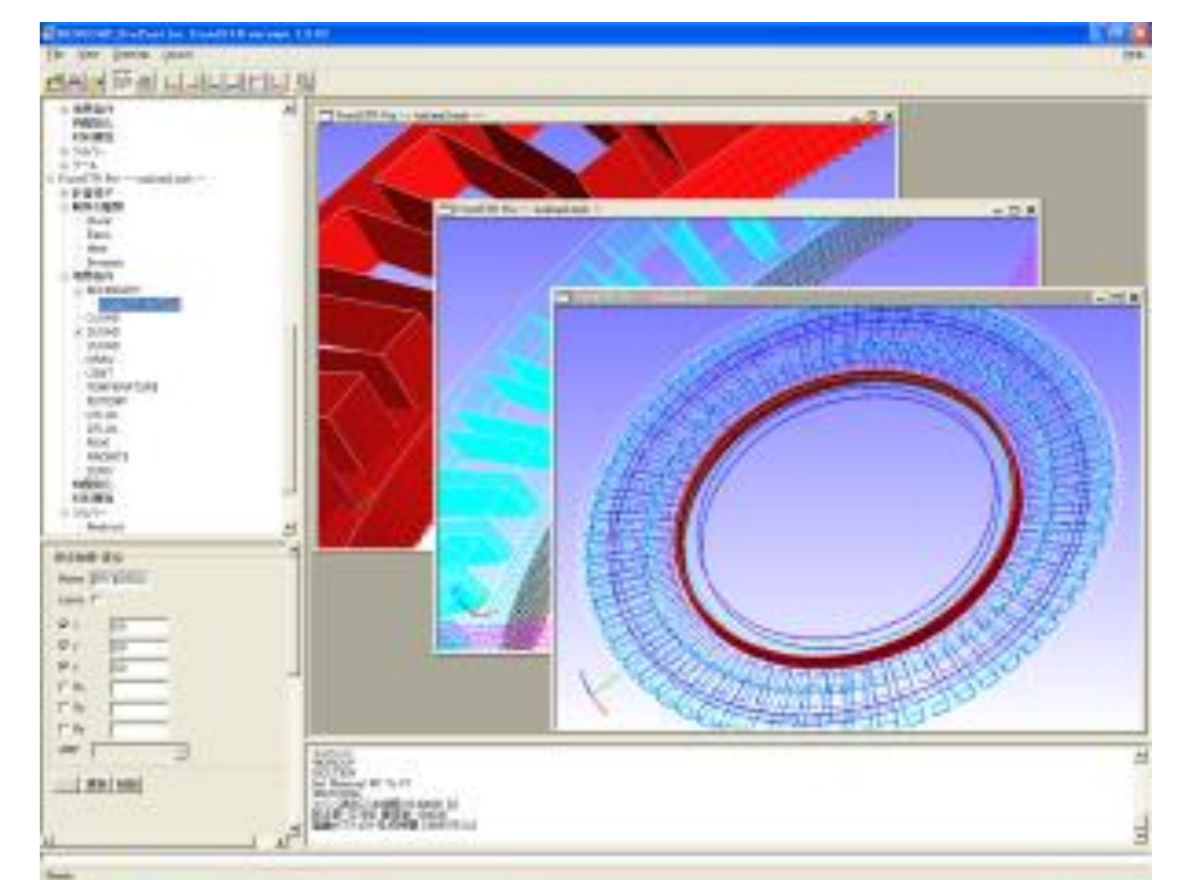
User Interface: REVOCAP_PrePost

Global control   Analysis control   Mesh data

Boundary cond.
Material const.
Analysis param.
Visualization param.

Partitioner

Serial   Parallel

Front ISTR

on-line visualization

Restart data   Log   Results   off-line vis   Figures

· REVOCAP Pre/Post,
· AVS, FEMAP

Visualizer

SPMD (Single Program Multiple Data)

REVOCAP_PrePost (IGES data, mesh generation, assembly and BC settings)

Function		Supported contents
Static	Material	Elastic/Hyper-elasticity/Thermal-Elastic-Plastic/Visco-Elastic/Creep, Combined hardening rule
	Geometry	Total Lagrangian／Updated Lagrangian
	Boundary	Augmented Lagrangian/Lagrangian multiplier method, Finite slip contact, Friction
Dynamic		Linear/Nonlinear, Explicit/Implicit
Eigen value		Lanczos method (with differential stiffness)
Heat		Steady / Non-steady (implicit), Nonlinear