Thermal Fluid-Aeroacoustics System
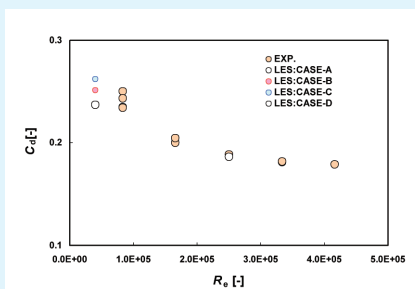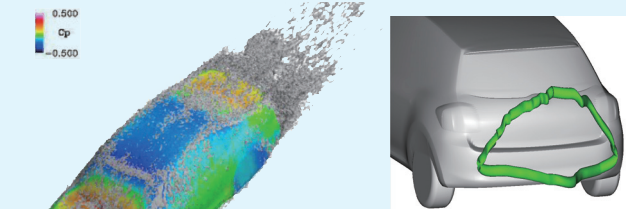# FrontFlow/blue (FFB)
FFB
FFB-ACOUSTICS

Accurate Prediction of Turbulent Phenomena (Sound, Vibration, Heat Transfer, etc.)!

Large Scale Computation up to 100 Billion Grids High Sustained Performance on Various Kinds of Machine Various Applications in Industry (Turbomachinery, Aeroacoustics, etc.)
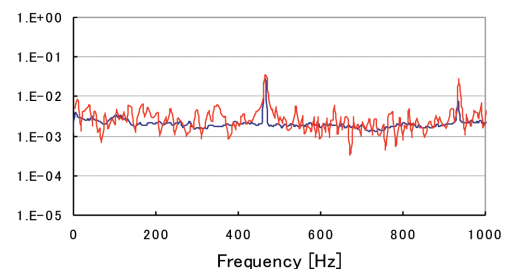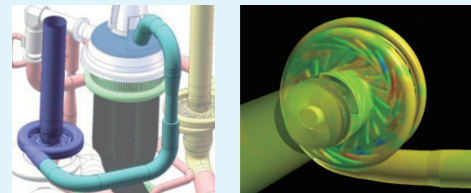
Applications

Car with Low Drag Force

7% Drag Force Reduction by Controlling Unsteady Vortices in the Wake of a Car

TOYOTA MOTOR CORPORATION

Fuel Pump for Rocket Engine

Accurate predictions of pump's pressure fluctuation, useful for improving safeness of rocket engine
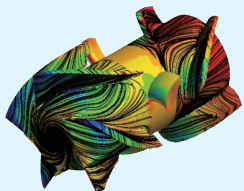

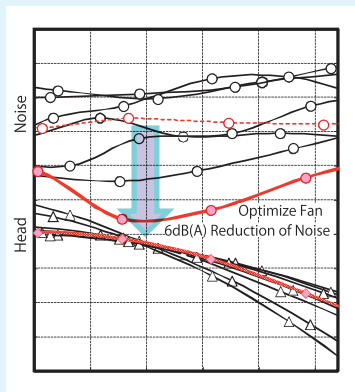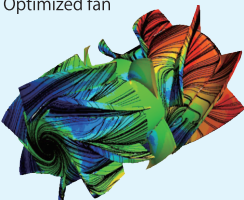Japan Aerospace Exploration Agency

Fan with Low Acoustic Noise

6 dB(A) Noise Reduction by Blade Optimizations
(patent applied)

Original fan
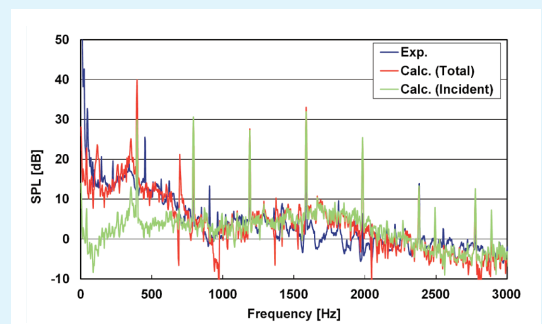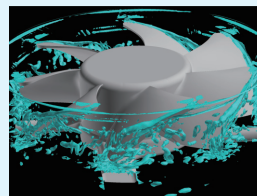
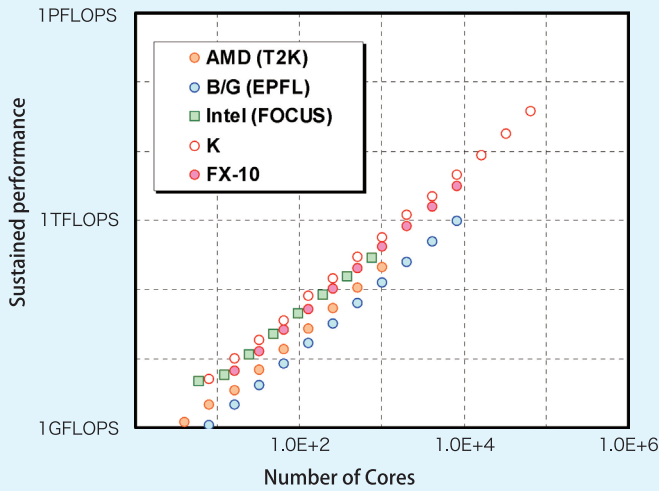Optimized fan

Optimize Fan
6dB(A) Reduction of Noise

FUJITSU Advanced Technologies Limited
SANYO DENKI CO., LTD.

Prediction of Acousic Noise from a Fan

Features

High Parallel Efficiency
~ Scalability up to 1 million cores ~

Legend:
- AMD (T2K)
- B/G (EPFL)
- Intel (FOCUS)
- K
- FX-10

Y-axis: Sustained performance (1PFLOPS, 1TFLOPS, 1GFLOPS)
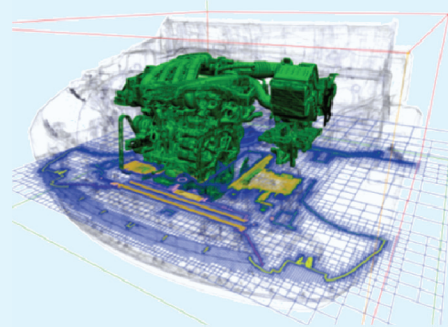X-axis: Number of Cores (1.0E+2, 1.0E+4, 1.0E+6)

(EPFL: Swiss Federal Institute of Technology)
(FOCUS: Foundation for Computational Sience)

Large Data Handing Technology
Accurate Predictions of Turbulence
by Auto Mesh Refinement Functions

Non-refined

Refined

EXP.
LES(FFB6, No-Refine)
LES(FFB6, Refine)

Y-axis: U (1.5, 1.0, 0.5, 0.0, -0.5)
X-axis: Y/D (-3.0, -2.0, -1.0, 0.0, 1.0, 2.0, 3.0)
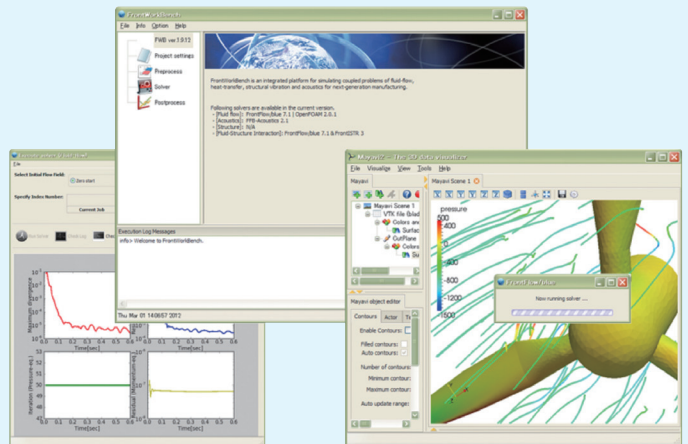
Data Interface of Voxel Mesh Generator (VCAD)

Voxel Mesh
in Engine Room of a Car
(VCAD, Nissan Motor Co., Ltd.)

Functions

Fluid		3D incompressible flow (steady & unsteady)
Physical model	Turbulence	LES (SSM, DSM), DES, RANS
	Heat transfer	Forced & natural convection
	Cavitation	Source-sink model of cavitation based on homogeneous media
	Aeroacoustics	Acoustic solver (FFB acoustics)
	Fluid structure interaction	One way coupling by REVOCAP_Coupler
Numerical scheme	Discretization	Finite element method (Tet., Wedge, Pyramid, Hex.) Voxel mesh
	Time integration	Crank-Nicolson Method Fractional step
	Parallel computation	Scalability up to 1 million domains Domain decomposition by METIS
	Function	Multi-frame of reference Overset method Auto global and local mesh refinement Arbitrary Lagrangian-Eulerian method

User Interface : FrontWorkBench
Easy Large Data Handling
by User Guide Functions and Data Management