THE UNIVERSITY OF TOKYO

RISS Research and Development of Innovative Simulation Software

RSS21 Revolutionary Simulation Software

Multi-Mechanics Simulation Open Software
REVOCAP

REVOCAP_Coupler
REVOCAP_Refiner
REVOCAP_PrePost

Achieves large-scale multi-physical analysis in various parallel-computing environments!

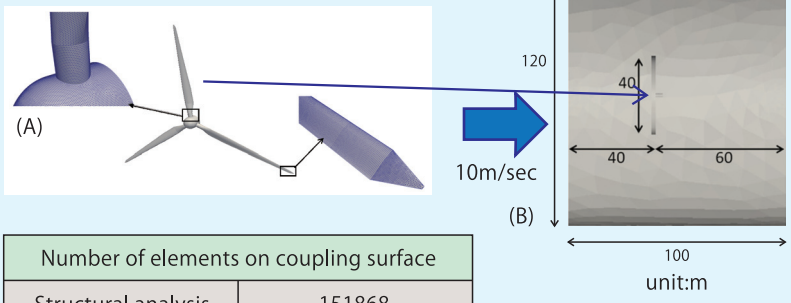
Couples FrontISTR(FISTR) parallel structural analysis software
and FrontFlow/blue(FFB) parallel fluid analysis software

Feasibility Studies

Fluid-structure interaction of a wind turbine (One-way coupling)

Normal tractions obtained by CFD is applied to the surface of blades in the subsequent structural analysis

(A) Coupling mesh (B) entire analysis domain of CFD

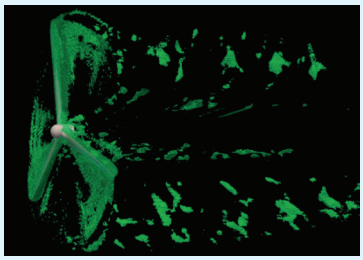


Number of elements on coupling surface	
Structural analysis	151868
Fluid analysis	74242

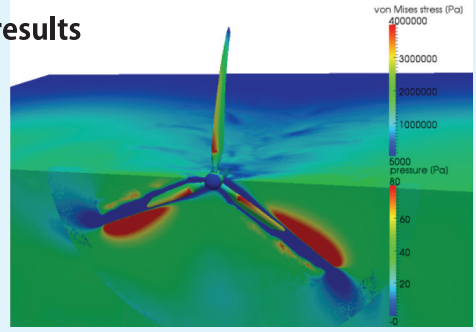
Number of elements in structural analysis	
tetra.	623K
penta.	2K
hexa.	134K

Fluid analysis domain	Number of tetra elements
Outside Stationary domain	5460K
Rotational part of wind turbine	9500K

(A) Flow pattern (B) a snapshot of FSI analysis results

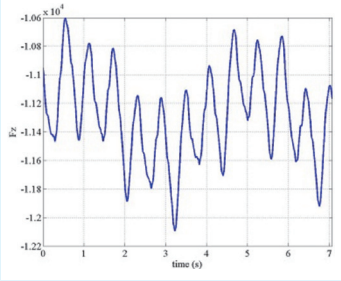


(A)
iso-surfaces of
velocity (11m/sec)

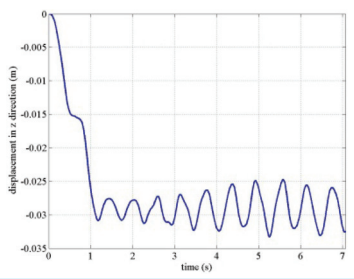


(B)
pressure contour
in fluid, blade
deformation(×100)
and von-Mises stress
contour on blade

(A) Drag (B) displacement at a tip of blade



(A)



(B)

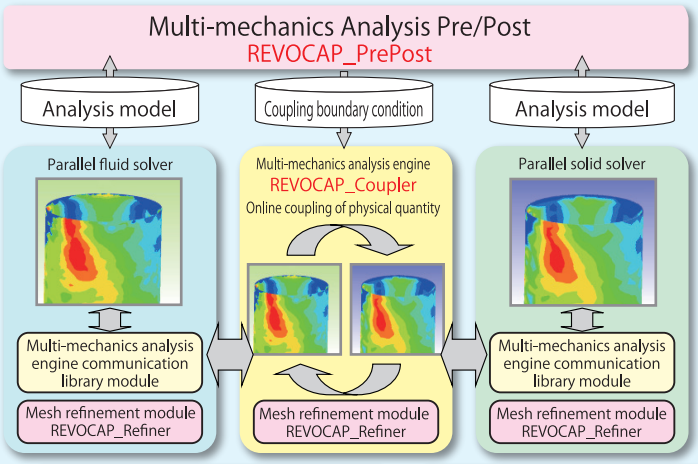
Computational performance

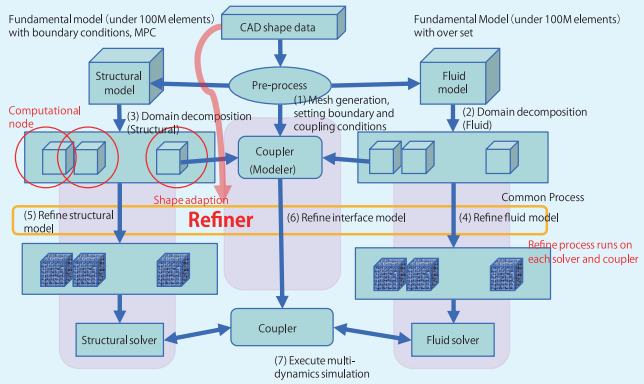
Solver	Number of cores	CPU time(sec) / time step
Fluid : FFB	128	1.254
Structure : FISTR	32	18.50

Computer CX1000 Cluster in IIS, The University of Tokyo
CX1000 (Intel Xeon X5670：2.93GHz, 6Core×2CPU, 48GB)
36 nodes 432 cores, Theoretical peak performance
5.67TFLOPS, main memory 1.68TB

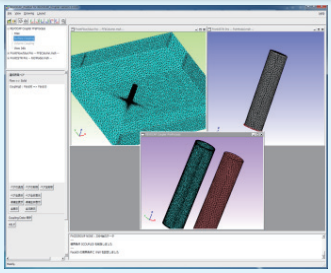
Feature works

Example of fluid-structure interaction system

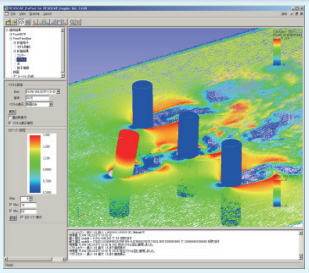




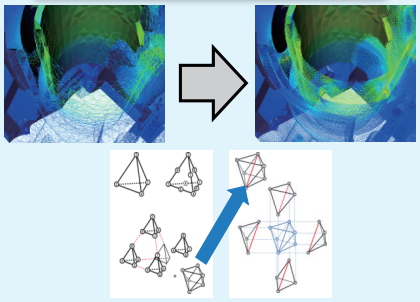
Example of setting coupling surfaces in fluid-structure integration (FSI)



Example of post-processing of fluid-structure interaction (FSI) analysis around cylinders



Example of refinement of model and tetrahedron using REVOCAP_Refiner



Functions

Module	Function	Supported content
Coupler	Method	Single/Parallel weak coupling on partitioned method Online coupling by embedded library Partitioned iterative methods
	Solver	Fluid/Structure/Magnetic/Thermal solvers for large-scale and assembled-structure
	Physical quantity	Traction, Displacement, Velocity, Acceleration, Heat flux, Temperature on coupling surface
	Element type	Tetrahedron 1st/2nd, Hexahedra 1st, Prism 1st, Pyramid 1st
	Related module	REVOCAP_PrePost, REVOCAP_Refiner
Refiner	Element type	Tetrahedron, Hexahedron, Prism, Pyramid (1st, 2nd)
	Method	Online refinement by embedded library Auto updating boundary and other conditions on refining
PrePost	Solver	FrontFlow/blue, FrontISTR, REVOCAP_Magnetic, ADVENTURE_Solid
	Mesh generation	Automatic tetrahedral mesh generation from CAD files formatted IGES, STEP, STL (using ADVENTURE_TetMesh)
	Pre-process	Boundary conditions, Analysis conditions, Coupling conditions, File transfer
	Post-process	Color contour, Deformation, Vector, Section, Isosurface, Movie

Platforms

■ Coupler、Refiner

OS: Linux (32 bit, 64 bit)
C Compiler: gcc, Intel C
Fortran Compiler: Intel Fortran
Supercomputers: The Univ. of Tokyo HA8000 (T2K)

■ PrePost

OS：Windows XP, Windows Vista, Windows 7, Linux (32bit, 64bit)

Documents/Examples (PrePost)

Installation manual/User's manual/Tutorial guide (Japanese only)
22 examples of structural, fluid, and magnetic analyses

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