

Research of Multi-Physics Simulation Technology

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● Abstract

The purpose of this research is to obtain the simulation technology to analyze phenomena relating with multi-physics such as acoustic fluid dynamics and multi-phase flows.

● Reasons and benefits of using JAXA Supercomputer System

JSS2 was used to conduct the simulation of liquid with a particle method, which needs the resource of JSS2 to deal with tens of millions particles in a large computational domain.

● Achievements of the Year

Water spray generated from a tire of an aircraft running on flooded runway was simulated using explicit MPS method, and examined the effect of the contact area between the tire and the ground. It was found that the water spray angle gets close to the experimental data by assuming the point contact. Also, we developed a coupling code of P-Flow (particle-base solver) and FaSTAR (grid-base solver), and validated it with the jet break-up problem.

● Publications

- Oral Presentations

1)S. Koga, K. Kubota, Y. Iijima, S. Koike, K. Nakakita:Quasi-Full-Scale Test for Prediction Technology of Water Spray Generated by Aircraft Tire and Comparison with Numerical Analysis, Proceedings of the Fluid Dynamics Conference/Aerospace Numerical Simulation Symposium 2021 Online, 2A07, 2021.

2)H. Tsujimura, K. Kubota, T. Sato: Numerical Analysis of Water Spray from Firefighting Aircraft Using Grid and Particle Methods Coupled by

the Aerodynamic Force Model, Proceedings of the Fluid Dynamics Conference/Aerospace Numerical Simulation Symposium 2021 Online, 1E01, 2021.

3)H. Tsujimura, K. Kubota, T. Sato: Numerical Analysis of Liquid Jet Breakup Using Particle-grid Hybrid Method, 35th CFD Symposium, C10-2, 2021.

● **Usage of JSS**

● **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	80 - 270
Elapsed Time per Case	10 Hour(s)

● **JSS3 Resources Used**

Fraction of Usage in Total Resources*1(%): 0.40

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage*2(%)
TOKI-SORA	404,745.21	0.02
TOKI-ST	2,047,750.06	2.52
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	255,321.81	19.03
TOKI-TST	0.00	0.00
TOKI-TGP	0.00	0.00
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2(%)
/home	1,262.08	1.26
/data and /data2	22,052.67	0.24
/ssd	503.33	0.13

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	6.32	0.04

*1: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

*2: Fraction of Usage : Percentage of usage relative to each resource used in one year.

● **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage*2(%)
ISV Software Licenses (Total)	114.77	0.08

*2: Fraction of Usage : Percentage of usage relative to each resource used in one year.