## **Research on Particle Simulation Methods**

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#### Abstract

The purpose of this research is to obtain the simulation technology of particle simulation, known to be useful for analysing multi-physics phenomena, to accelerate aircraft development.

#### Reasons and benefits of using JAXA Supercomputer System

JSS3 was used to conduct the simulaiton of liquid with a particle method, which needs the resource of JSS3 to deal with tens of millions particles in a large computational domain.

### Achievements of the Year

We analyzed the water spray from aircraft tires on an actual scale using the particle method. The airflow around the actual aircraft was analyzed in advance, and based on the airflow information, the water spray generated from the nose gear was simulated. The simulation results were compared with the actual test, and it was confirmed that the angle between the water film and the runway was consistent with the test result. On the other hand, it was also found that there was a slight difference between the simulation and the test results on the water distribution bounced forward, suggesting the need for higher particle resolution.

#### Publications

[1]K. Kubota, S. Koga, Y. Iijima, S. Koike, K. Nakakita: Research on Advancement of Prediction Technology for Water Spray from Aircraft Tire, 41st Aerospace Numerical Simulation Symposium, 3D04, 2023.

[2]K. Kubota: Research and Development for Predicting Water Spray Generated from Aircraft Tires, Prometech Simulation Conference 2023.

[3] H. Tsujimura, K. Kubota: Modeling wettability effect in the surface-tension-as-pressure model for particle methods, 37th CFD Symposium, 2410-13-04, 2023.

# Usage of JSS

# • Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	80 - 256
Elapsed Time per Case	168 Hour(s)

# • JSS3 Resources Used

Fraction of Usage in Total Resources<sup>\*1</sup>(%): 1.20

Details

Computational Resources		
System Name	CPU Resources Used	Fraction of Usage <sup>*2</sup> (%)
	(core x hours)	
TOKI-SORA	32,384,652.80	1.46
TOKI-ST	38,974.60	0.04
TOKI-GP	0.00	0.00
TOKI-XM	0.02	0.00
TOKI-LM	605.51	0.05
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 <sup>*2</sup> (%)
/home	248.71	0.21
/data and /data2	7,255.43	0.04
/ssd	0.00	0.00

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage <sup>*2</sup> (%)
J-SPACE	0.00	0.00

\*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	Fraction of Usage <sup>*2</sup> (%)
	(Hours)	
ISV Software Licenses	17.05	0.01
(Total)		0.01

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