Research on Particle Simulation Methods

Report Number: R22EDA201G19
Subject Category: Aeronautical Technology
URL: https://www.jss.jaxa.jp/en/ar/e2022/20816/

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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 JSS2 to deal with tens of millions particles in a large computational domain.

Achievements of the Year

Water spray generated from an aircraft tire was simulated using particle simulation method. In this year, the pressure osscilation appeared at the narrow region between the tire and runway was alleviated by improving the wall model. Also, elastic deformation analysis of the tire became possible, and consistency with the experimental data was confirmed. While tire deformation have been determined via testing, it became possible to predict tire deformation just by simulation.

Publications

- Oral Presentations

K. Kubota, S. Koga, Y. Iijima, S. Koike, K. Nakakita: Numerical Simulation and Quasi-Full-Scale Test for Prediction Technology of Water Spray from Aircraft Tire, Proceedings of the 54th Fluid Dynamics Conference/40th Aerospace Numerical Simulation Symposium, 1E04, 2022.

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	80 - 256
Elapsed Time per Case	72 Hour(s)

JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 0.48

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	10,917,325.37	0.48
TOKI-ST	670,688.31	0.67
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	610.61	0.04
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	138.89	0.13
/data and /data2	5,347.56	0.04
/ssd	27.78	0.00

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
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 (Hours)	Fraction of Usage*2 (%)
ISV Software Licenses (Total)	62.49	0.04

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