

## Construction of LES model for high-Mach-number multiphase turbulent flows based on DNS

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### ● Abstract

Direct Numerical Simulation (DNS) of the flow around a single particle in a compressible low Reynolds number flow is performed to understand the high Mach number solid-gas mixed phase turbulence, and the effect of the presence of particles on the high-speed turbulence phenomenon is clarified.

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

In this project, direct numerical simulation (DNS) of high Mach number and low Reynolds number flow around a particle and construction of the data base will be carried out using a boundary-fitted coordinate system. Large scale numerical simulation is essential to construct the data base.

### ● Achievements of the Year

We planned to carry out the analysis this year, but as a result of organizing the results so far, we have not performed the analysis because it is no longer necessary. We organized the calculation data that was done up to last year, wrote a treatise, and prepared the simulation code for the next calculation.

### ● Publications

- Peer-reviewed papers

Nagata, T., Nonomura, T., Takahashi, S., and Fukuda, K., "Investigation on subsonic, transonic and supersonic flow over an isolated sphere up to a Reynolds number of 1000 by direct numerical simulation," *Journal of Fluid Mechanics*, Vol. 904, A36 (2020)

● Usage of JSS

● Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	289
Elapsed Time per Case	0.1 Second(s)

● Resources Used(JSS2)

Fraction of Usage in Total Resources\*1(%): 0.03

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2(%)
SORA-MA	97,250.85	0.02
SORA-PP	0.00	0.00
SORA-LM	0.00	0.00
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2(%)
/home	39.21	0.04
/data	22,871.24	0.44
/ltmp	2,712.67	0.23

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	31.90	1.06

\*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.

- **Resources Used(JSS3)**

Fraction of Usage in Total Resources\*1(%): 0.02

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2(%)
TOKI-SORA	0.00	0.00
TOKI-RURI	0.00	0.00
TOKI-TRURI	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2(%)
/home	65.70	0.05
/data	32,094.33	0.54
/ssd	137.75	0.07

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	31.90	1.06

\*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.