Aerodynamics of Re-entry Vehicle System with Inflatable Ballute

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Abstract

To determine the aerodynamic characteristics of a flight vehicle equipped with an inflatable ballute. In particular, the influence of the deformation of the ballute on the aerodynamic characteristics will be investigated.

Reasons and benefits of using JAXA Supercomputer System

There have been many shapes depending on the deformation of ballute with various flight conditions such as Mach number and the tilt angle.

Achievements of the Year

In this year's analysis, we investigated the flow field around a flight vehicle equipped with a ballot in the transonic region. The baloot geometry was created using OpenSCAD, a software program that can create geometry using mathematical formulas. The grid required for the analysis was created using HexaGrid v1.2.1, and the analysis was performed using the JSS version of FaSTAR. In the transonic region, the shock wave formed around the experimental wind tunnel model is strongly reflected by the flow path in the wind tunnel. To reproduce this phenomenon, a dense computational grid was created over almost the entire computational domain, and a target wall condition was set on the wall surface to account for reflections in the channel. As a result, it was possible to qualitatively reproduce the shock wave formed in front of the model and the shock wave reflected in the wind tunnel channel.

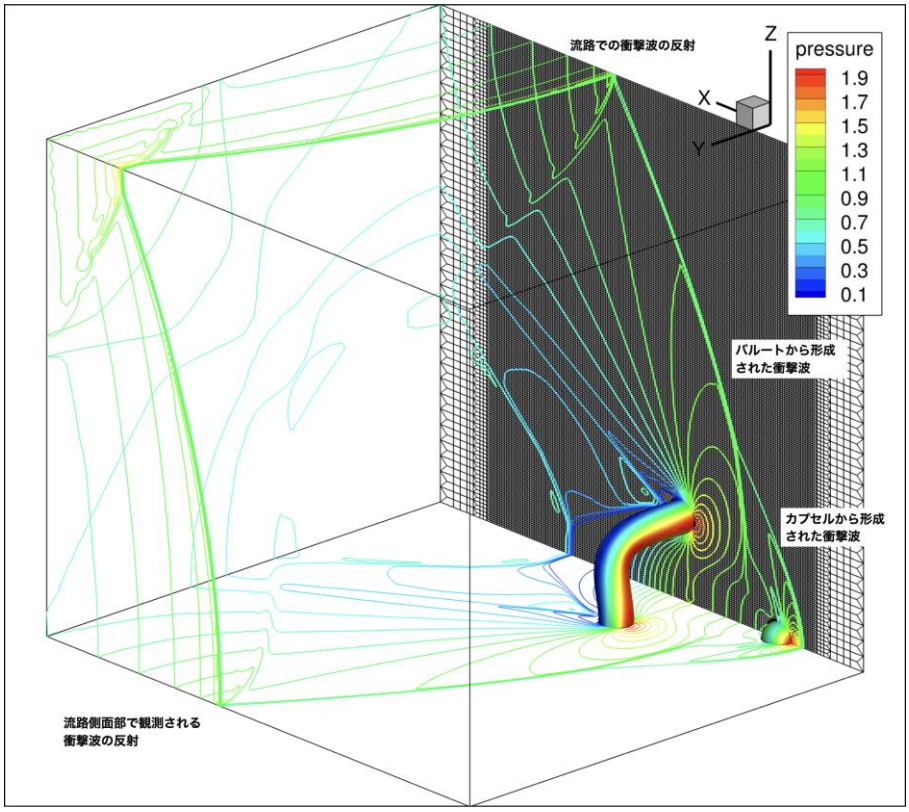

Fig. 1: CFD Reproduction of Shock Wave Shapes around Balut in Transonic Wind Tunnel Experiments

Publications

- Oral Presentations

"Fabrication of experimental wind tunnel model using 3D printer and its application to transonic wind tunnel experiments," ISAS2023-SFMA-023

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	64 - 192
Elapsed Time per Case	60 Minute(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.00

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	592.92	0.00
TOKI-ST	27.69	0.00
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	0.00	0.00
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	0.00	0.00
/data and /data2	0.00	0.00
/ssd	0.00	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)	0.00	0.00

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