

DSMC analysis of the rarefied gas flows

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● Abstract

To understand the rarefield gas flow phenomenon in high altitude and outer space, which is difficult to conduct ground test, and to predict the aerodynamic / thermal environment for reentry and the thermal load of gas plume from a thruster, we aim to develop a practical tool that can deal with actual shape and short analysis period.

<http://www.kenkai.jaxa.jp/eng/research/software/software.html>

● Reasons for using of JSS2

In order to respond timely to project requirements, it is necessary to simulate complex geometries of actual spacecraft and to analyze a large number of conditions in a short period.

● Achievements of the Year

We evaluated the risk of abnormally high temperature due to the interaction between the thruster plume and the loading of the HTV-X by using the rarefield gas flow analysis tool developed at Research Unit III. It predicted the plume interaction and the heat load with the loading. We contributed to changing the RCS thruster attachment position and angle. Figure 1 shows the simulation result of HTV-X.

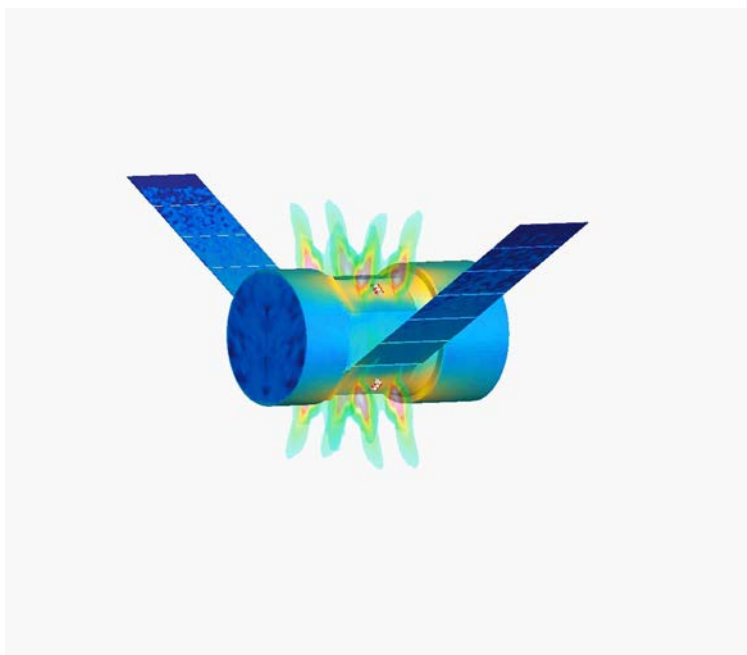


Fig.1 Plume simulation for HTV-X, number of density distribution

● Publications

- URLs for the Research Results on the Web

1) <http://www.kenkai.jaxa.jp/eng/research/software/software.html>

● Usage of JSS2

● Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	300 - 625
Elapsed Time per Case	50.00 hours

● Resources Used

Fraction of Usage in Total Resources*1 (%): 0.99

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	8,234,867.05	1.08
SORA-PP	1,337.81	0.02
SORA-LM	4.64	0.00
SORA-TPP	11.25	0.00

File System Resources		
File System Name	Storage assigned(GiB)	Fraction of Usage*2 (%)
/home	509.62	0.35
/data	25,306.17	0.47
/ltmp	16,404.39	1.24

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	0.24	0.01

*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