Numerical study on unsteady flow fields around a re-entry capsule

Report Number：R17ETET12
Subject Category：Skills Acquisition System
URL：https://www.jss.jaxa.jp/ar/e2017/4471/

Responsible Representative

Takashi Takahashi, Aeronautical Technology Directorate, Numerical Simulation Research Unit

Contact Information

Kenji Kobayashi　knjkoba@chofu.jaxa.jp

Members

Kenji Kobayashi

Abstract

Coherent structures around a re-entry capsule were investigated using the unsteady flow solver FaSTAR. A re-entry capsule shows dynamic instability in subsonic and transonic speeds. This study focused on the subsonic unsteady flow around the capsule and investigated the mechanism of the dynamic instability.

Reasons for using of JSS2

Large computational cost is required to simulate the unsteady flow field.

Achievements of the Year

Coherent structures around a reentry capsule at M=0.4 and 0.8 were simulated. It reproduced the fluid phenomena which had frequency of St ~ 0.01 , where St is the Strouhal number. We found this frequency was close to the frequency of the dynamic instability of the capsule.

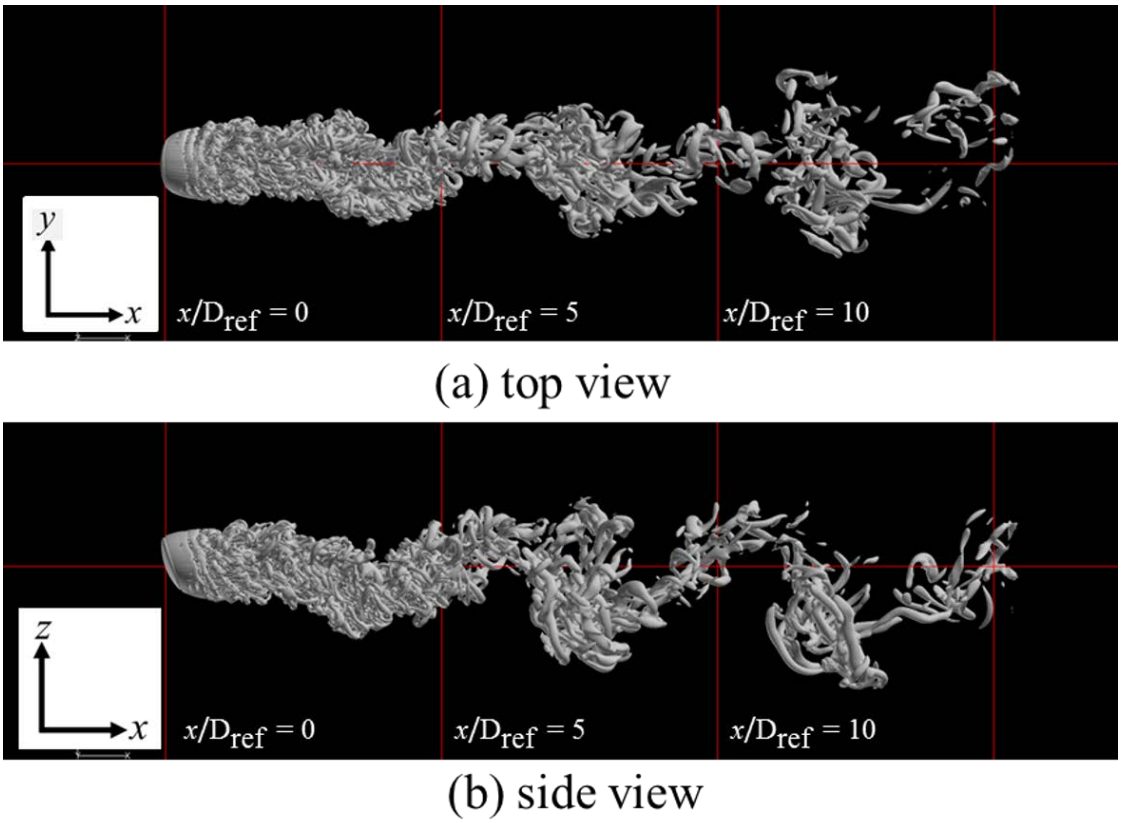

Fig.1 Instantaneous flow field of M = 0.4 (Iso-surface of Q-criterion))

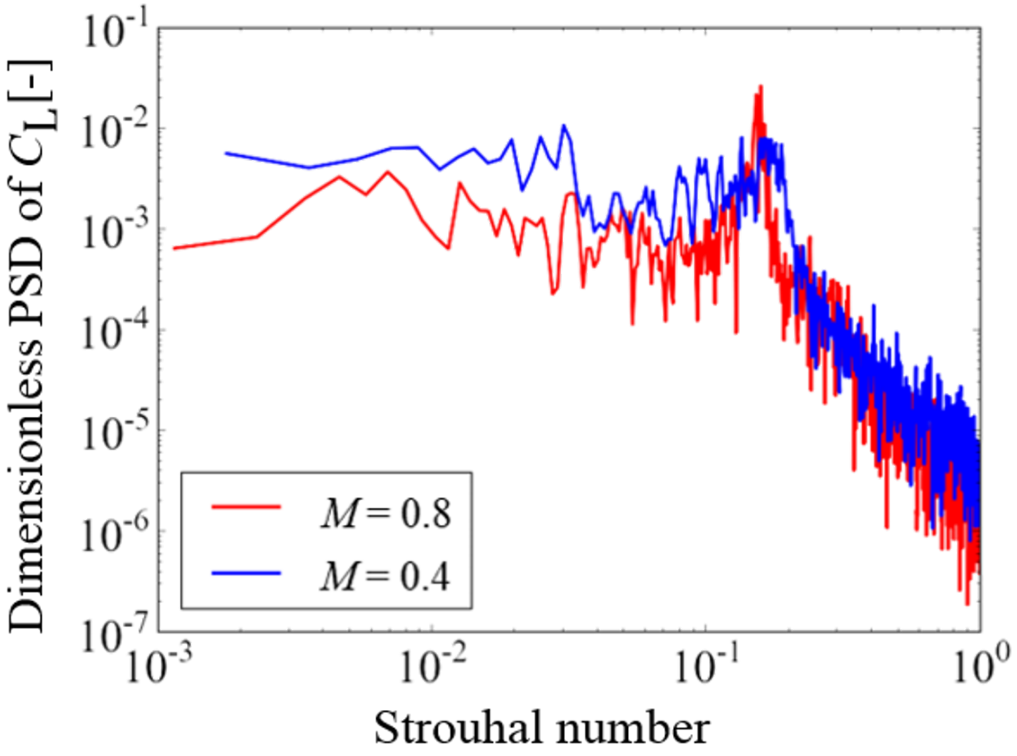

Fig.2 Frequency distribution of lift coefficient

Publications

N/A

Usage of JSS2

Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	512
Elapsed Time per Case	700.00 hours

Resources Used

Fraction of Usage in Total Resources*1 (%): 0.13

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	533,290.78	0.07
SORA-PP	14,231.82	0.18
SORA-LM	17,487.62	9.01
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage assigned(GiB)	Fraction of Usage*2 (%)
/home	238.42	0.17
/data	42,480.49	0.79
/ltmp	976.56	0.07

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	5.80	0.25

*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