Study on Aerodynamic Design for Mars Exploration Airplane

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Abstract

The discussion on the aerodynamic characteristcs for a Mars exploration airplane is conducted.　The conditon of the airplane is the low Reynolds number and high high Mach number conditions, and the data for conventional airplanes on Earth cannot be direcrely applied to the design of a Mars airplane. So, study with CFD of these conditions around the wing is conducted for a Mars exploration airplane.

Reasons for using of JSS2

A huge computational cost is required when three-dimensinal simulation with　CFD.　So, the computations with a super-computer are necessary to conduct our research because the available memory and CPU of supercomputer like JSS2 are much larger than the workstation at our laboratory.

Achievements of the Year

Three-dimensinal Numerical simulations of NACA0002 was conducted as shown in Fig. 1. Then, the aerodynamic characteristics were evaulated. The result indicates that the monotonic increases of lift and drag coefficents occurs (Fig. 2). Then,　as the angle of attack increases, it was confirmed that the pressure drag is increased while viscous drag is decreased.　We are planning to consider the Mach number effect of this above result and investigate the change in the aerodynamic characteristics.

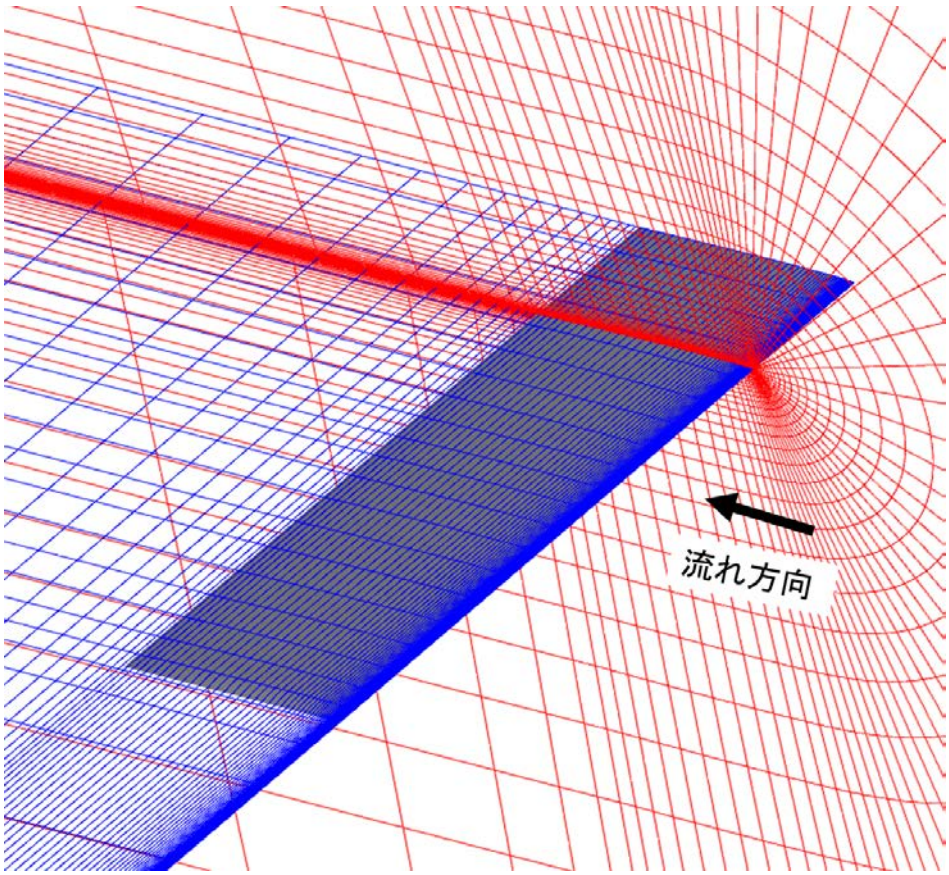

Fig.1 Computational grid

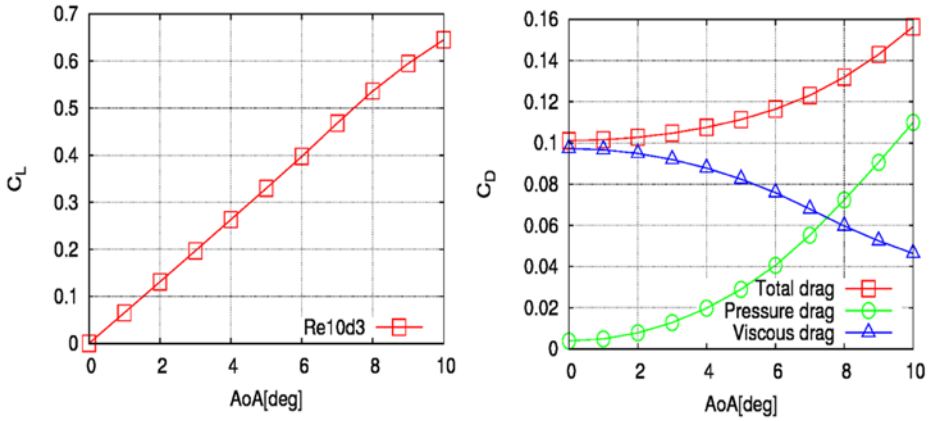

Fig.2 Aerodynamic characteristics at low Reynolds condition

Publications

- Non peer-reviewed papers

1) S. Morizawa, K. Sakamoto, A. Yasuda, A. Miyazaki, H. Kawazoe, "Aileron Effect by the Elevon on the Aerodynamic Characteristics of a Mars Exploration Airplane with a Deployable-Wing, The 2016 Asia-Pasific Internatinal Symposium on Aerospace Technology, D1-2 , Toyama, Japan, October 25-27, 2016."

Usage of JSS2

Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	32
Elapsed Time per Case	300.00 minutes

Resources Used

Fraction of Usage in Total Resources*1 (%): 0.01

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	34,896.09	0.00
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	158.95	0.11
/data	3,255.21	0.06
/ltmp	651.04	0.05

Archiver Resources		
Archiver System 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