

Study of high speed fluid

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● Abstract

We conduct fundamental research on aerodynamics such as aerodynamic acoustic noise generated by supersonic jet and aerodynamic design of Mars aircraft.

● Reasons for using of JSS2

Large eddy simulation is required for analysis of aeroacoustics generated from a supersonic jet. Aerodynamic design of Mars airplane requires several hundred cases of CFD computation. Therefore, a supercomputer is necessary.

● Achievements of the Year

Aerodynamic airfoil design optimization of flying-wing-type Mars airplane has been conducted. The result show that there is a tradeoff between maximizing lift to drag ratio and improving stability performance. A guideline for airfoil shape design has been also obtained. We also conducted uncertainty quantification of aerodynamic performance of an airfoil in low Reynolds number flow condition.

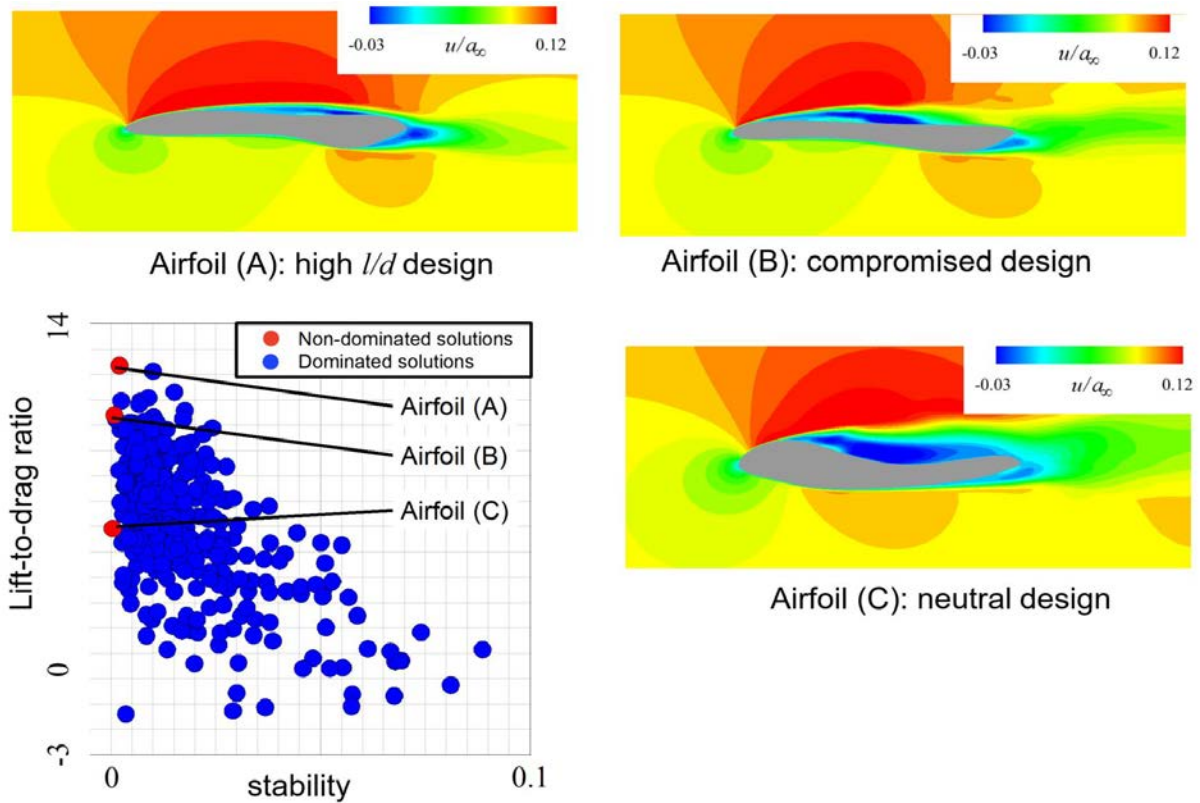


Fig.1 Aerodynamic airfoil design optimization of flying-type Mars airplane

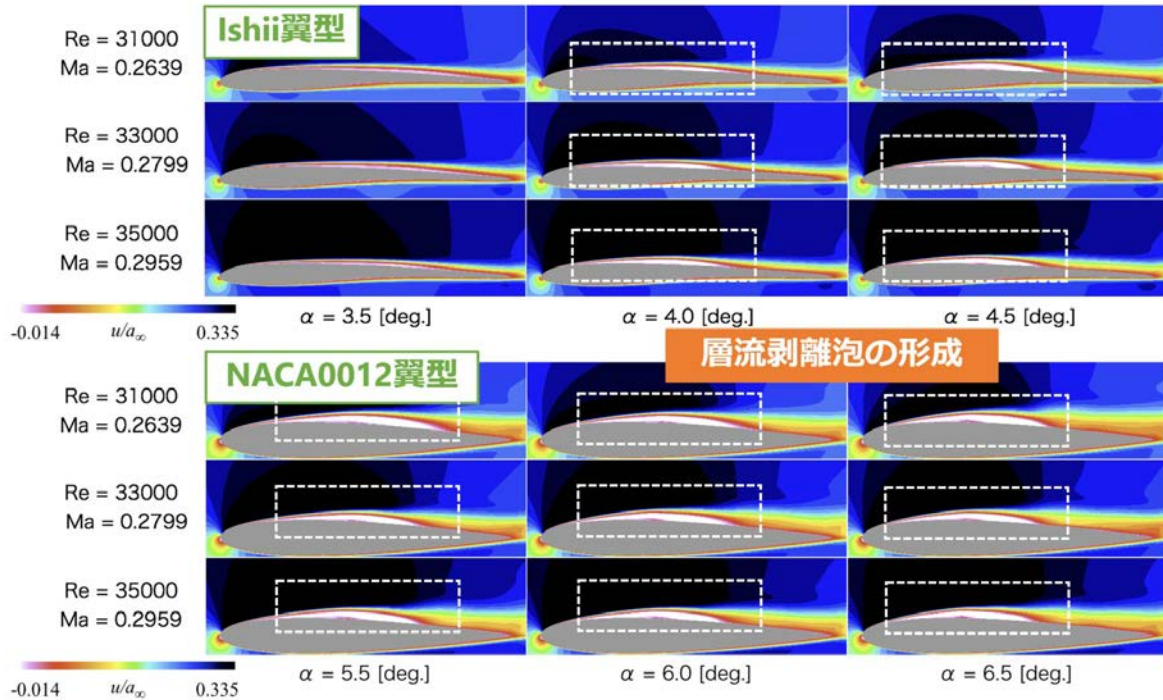


Fig.2 Uncertainty quantification of airfoil performance in low Reynolds number flow

● Publications

- Non peer-reviewed papers

- 1) Takuya Harada, Koji Fujita, Akira Oyama, Hiroya Mamori, Makoto Yamamoto, Aerodynamic Design of Airfoil for Flying Wing Mars Airplane, AIAA Scitech, Kissimmee, FL, US, Jan 8-12. 2018
- 2) Shigetaka Kawai, Thijs Bouwhuis, Yoshiaki Abe, Aiko Yakeno, Taku Nonomura, Akira Oyama, Harry Hoeijmakers, and Kozo Fujii, Investigation of Maximum Velocity Induced by Body-Force Fields for Simpler Modeling of Plasma Actuators, AIAA Aerospace Sciences Meeting, AIAA Science and Technology Forum and Exposition 2018, Kissimmee, FL, US, Jan 8-12. 2018
- 3) Hiroaki Fukumoto, Hikaru Aono, Taku Nonomura, Akira Oyama and Kozo Fujii, Large-Eddy Simulations of Flow Control Effects of a DBD Plasma Actuator at Various Burst Frequencies on a Dynamic Flowfield around a Pitching NACA0012 Airfoil at Reynolds Number of 256,000, AIAA Aerospace Sciences Meeting, AIAA Science and Technology Forum and Exposition 2018, Kissimmee, FL, US, Jan 8-12. 2018.

● Usage of JSS2

● Computational Information

Parallelization Methods	parametric study.
Thread Parallelization Methods	OpenMP
Number of Processes	52
Elapsed Time per Case	16.00 hours

● Resources Used

Fraction of Usage in Total Resources*1 (%): 1.83

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	14,918,585.64	1.97
SORA-PP	1,596.63	0.02
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	3,621.92	2.51
/data	86,487.83	1.60
/ltmp	18,013.20	1.36

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	3.98	0.17

*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