Unsteady Aerodynamics Simulation of Frontier Region

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Abstract

The objective of this study is to realize CFD that can be used in the entire flight envelope by investigating precise CFD technologies that can be applied to unsteady phenomena, such as aerodynamic buffeting and flow separation.

http://www.aero.jaxa.jp/eng/research/basic/numerical/unsteady-cfd/

Reasons for using of JSS2

Unsteady simulation is more than 1000 times cost compared with steady simulation. We need a supercomputer within a reasonable time.

Achievements of the Year

We computed a transonic buffet on NASA-CRM wing-body configuration. We used the Zonal-DES method and the wall model for the RANS region. We could reduce the number of grid by one-third. The Mach number is 0.85, the Reynolds number is 1.5×10^6, and the attack angle is 4.87deg. The grid was generated with BOXFUN and the number of grid is 21M cells. The average and RMS of pressure are shown in (Fig.1) and (Fig.2). The results with the wall model is close to the experimet. The instantaneous surface　pressure is shown in (Fig.3).　The buffet cells convects in the spanwise direction.

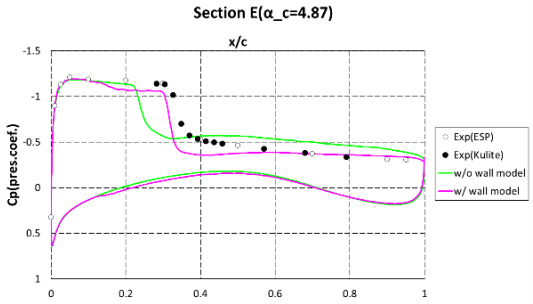

Fig.1 Average of pressure

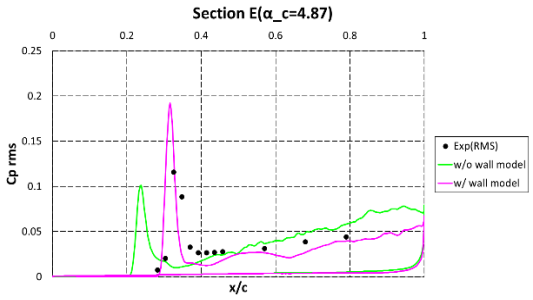

Fig.2 RMS of pressure

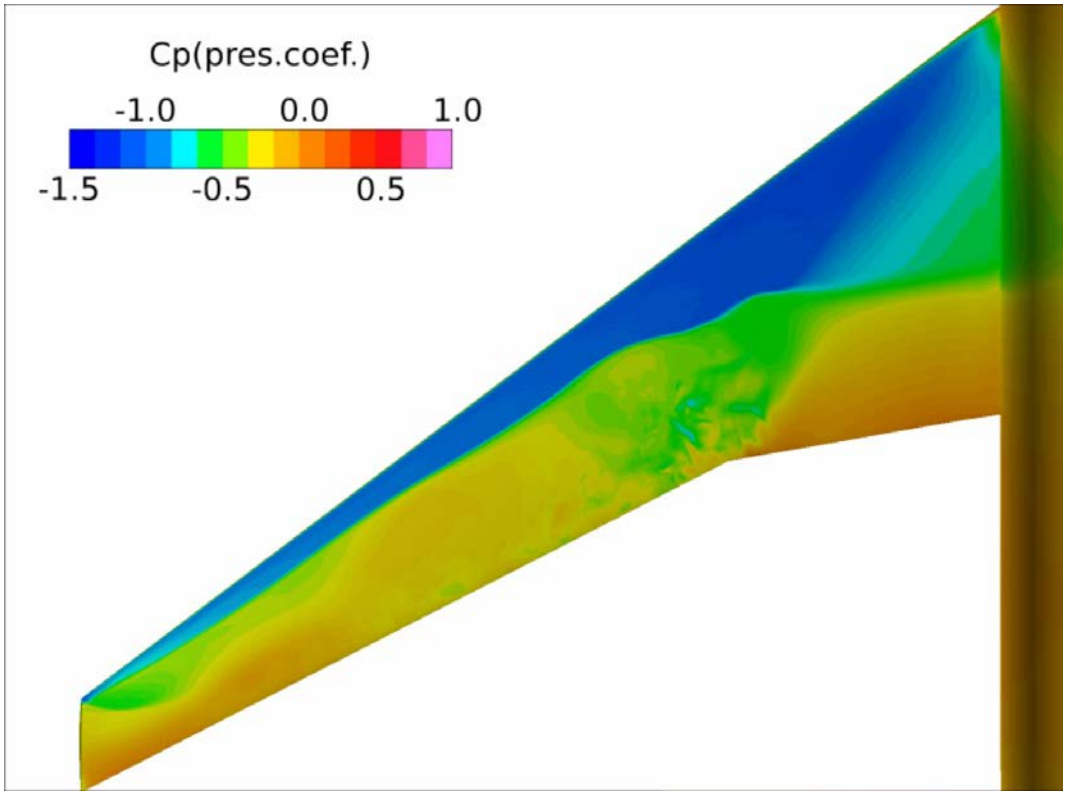

Fig.3 Surface pressure

Publications

- Presentations

1) Atsushi Hashimoto, Takashi Ishida, Takashi Aoyama, Yuya Ohmichi, Takahiro Yamamoto, and Kenji Hayashi. "Current Progress in Unsteady Transonic Buffet Simulation with Unstructured Grid CFD Code", 2018 AIAA Aerospace Sciences Meeting, AIAA SciTech Forum, (AIAA 2018-0788)

Usage of JSS2

Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	512 - 2024
Elapsed Time per Case	15.00 hours

Resources Used

Fraction of Usage in Total Resources*1 (%): 2.35

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	19,589,093.12	2.60
SORA-PP	41,299.17	0.52
SORA-LM	1,028.15	0.01
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage assigned(GiB)	Fraction of Usage*2 (%)
/home	194.41	0.13
/data	16,592.12	0.31
/ltmp	2,087.98	0.16

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	2.26	0.10

*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