Development of improved numerical tools for Certification by Analysis(CbA)

Report Number: R24EDA201G22
Subject Category: Aeronautical Technology
URL: https://www.jss.jaxa.jp/en/ar/e2024/27246/

Responsible Representative

Kazuyuki Nakakita, Aviation Technology Department

Contact Information

Andrea Sansica(sansica.andrea@jaxa.jp)

Members

David Lusher, Atsushi Hashimoto, Kenji Hayashi, Yuki Ide, Takashi Ishida, Masashi Kanamori, Yuko Maruyama, Tomoaki Matsuzaki, Yoimi Kojima, Yosuke Sugioka, Kosuke Uchida, Takahiro Yamamoto, Andrea Sansica

Abstract

High-accuracy simulations for stall and buffet are needed during the aircraft design. However, since the simulation cost is very high, we want to develop computation methodologies that aim at high-accuracy results with low computational cost. Hybrid RANS/LES methods (Embedded LES, ELES) have been implemented in FaSTAR and validated for different flow configurations.

Reasons and benefits of using JAXA Supercomputer System

For stall and buffet analysis, it is necessary to perform calculations on 3D complex geometries. Achieving high accuracy requires a large amount of computing power, so it is necessary to use a JAXA supercomputer.

Achievements of the Year

The ELES method developed up to last fiscal year was applied to the NASA CRM configuration under transonic buffet conditions. An examination of the time history of the lift coefficient confirmed that the buffet phenomenon was successfully reproduced. Furthermore, the results obtained using the ELES method were within 5% error compared to experimental data, achieving an accuracy equivalent to that of the high-fidelity WMLES method.

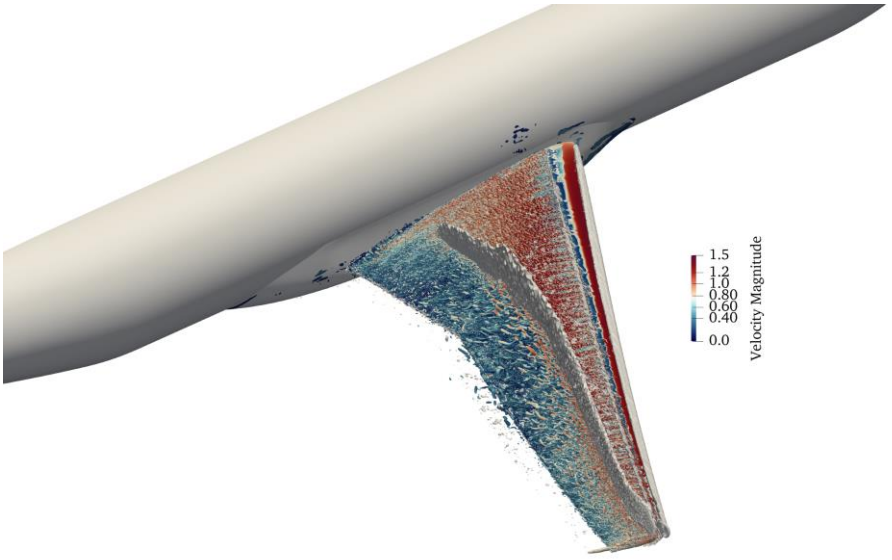

Fig. 1: Visualization of ELES for NASA-CRM model in transonic buffet condition

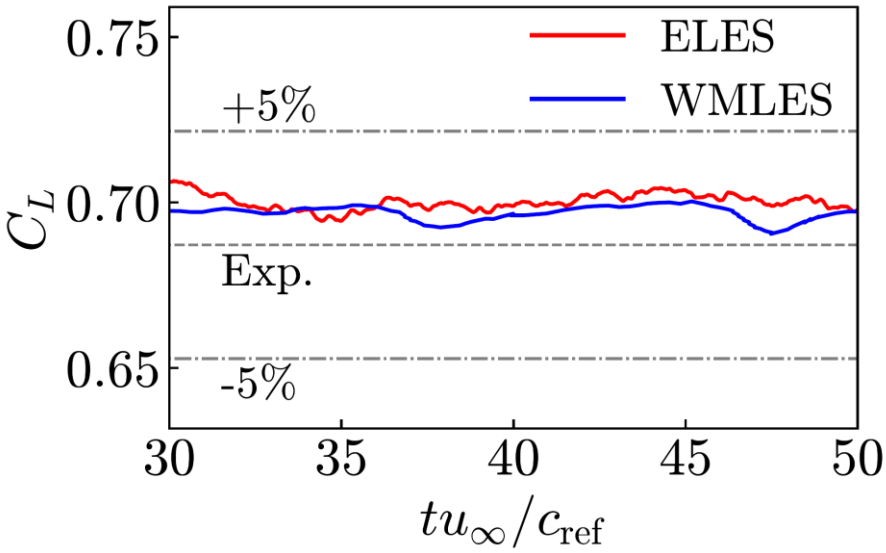

Fig. 2: Comparison of time histories of lift coefficient in several methods

- **Publications**

  N/A

- **Usage of JSS**

- **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	48 - 1537
Elapsed Time per Case	168 Hour(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 1.76

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	46,760,402.13	2.14
TOKI-ST	97,234.25	0.10
TOKI-GP	12.26	0.00
TOKI-XM	8,250.86	4.02
TOKI-LM	25,475.74	1.84
TOKI-TST	0.00	0.00
TOKI-TGP	0.00	0.00
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2] (%)
/home	2,186.63	1.47
/data and /data2	171,660.01	0.82
/ssd	37,253.97	2.00

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2] (%)
J-SPACE	23.00	0.08

[*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.

- **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage[*2] (%)
ISV Software Licenses (Total)	318.38	0.22

[*2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.