

Development of a high-precision unstructured mesh flow solver for aerodynamic design of turbomachinery cascade

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● Abstract

FaSTAR-Move-AE, a fluid analysis solver for unstructured meshes, which is mainly targeted at turbomachinery analysis, is developed. This solver will enable aerodynamic analysis of cascades with complex geometry with practical accuracy and cost, and will improve the turbomachinery design of Japanese engine manufacturers.

● Reasons and benefits of using JAXA Supercomputer System

For large scale computations in the future, programs should be tested under the same computational environment.

● Achievements of the Year

We are developing a fluid analysis solver for unstructured meshes FaSTAR-Move-AE, which mainly targets the analysis of turbomachinery cascade. In the current fiscal year, we have implemented the "DES/LES turbulence model", "low dissipation scheme", "inlet turbulence generation method" and "non-reflecting boundary method" with the aim of performing detailed unsteady analysis using DES/LES.

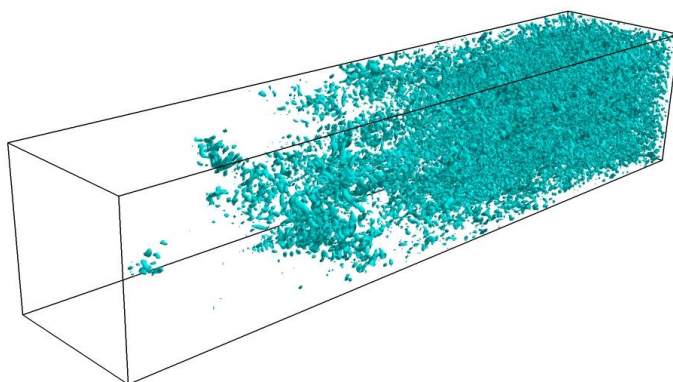


Fig. 1: Rectangular duct flow with turbulence generated at the inlet boundary by the turbulence generation function

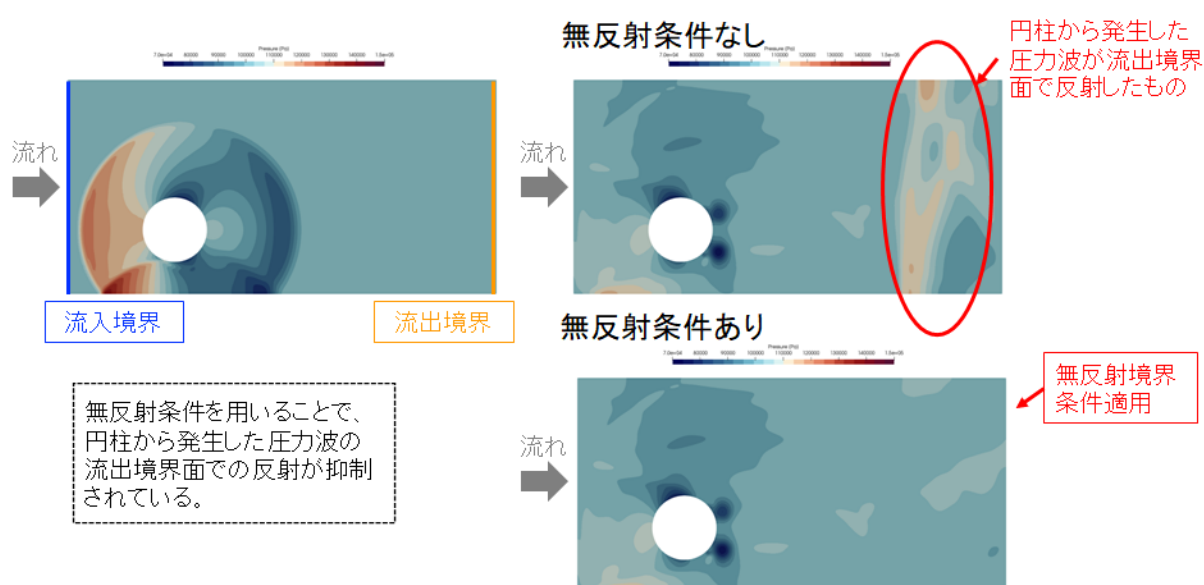


Fig. 2: Check of non-reflecting boundary method by a simple geometry case.

● Publications

N/A

● Usage of JSS

● Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	1 - 1024
Elapsed Time per Case	24 Hour(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources*¹(%): 0.07

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage* ² (%)
TOKI-SORA	1,975,579.92	0.09
TOKI-ST	2,886.08	0.00
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	0.00	0.00
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	204.24	0.19
/data and /data2	21,348.10	0.16
/ssd	2,241.50	0.31

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage* ² (%)
J-SPACE	9.27	0.04

*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)	48.61	0.03

^{*2}: Fraction of Usage : Percentage of usage relative to each resource used in one year.