Application of distributed micro plasma actuators

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Abstract

Plasma actuators (PAs) are flow control devices that use discharged plasma to generate wall jets from smooth surfaces. In recent years, a method of generating a distribution of body force on a surface by using a large number of small-scale PAs has been proposed by the applicants. The objective of this study is to obtain knowledge about the application method of plasma actuator and its optimization method for arbitrary control of the velocity profile of a three-dimensional boundary layer.

Reasons and benefits of using JAXA Supercomputer System

In order to perform large-scale 3D flow analysis and aerodynamic optimization with high computational costs, a supercomputer is required. The JAXA supercomputer, which provides an environment for the use of computational tools, is the most suitable environment for this study.

Achievements of the Year

A grid generation method for LES analysis for swept wings with a modification of airfoil has been tested, and an aerodynamic design method for distributed plasma actuator has been developed. An automatic grid generation program BOXFUN, based on the building-cube method, is used for grid generation, and a framework for automatic shape definition and optimal design is used to enable simultaneous optimization of distributed plasma actuator and airfoil shape based on numerical simulation.

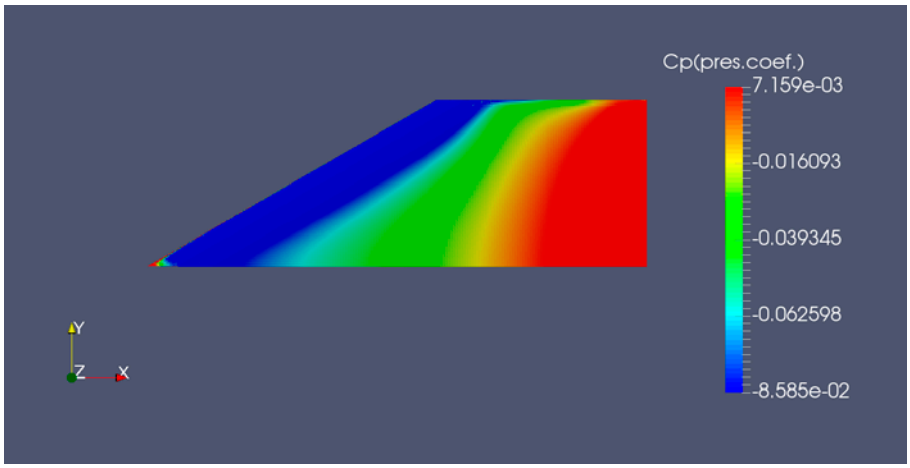

Fig. 1: Planform of swept wing and their pressure coefficient distributions

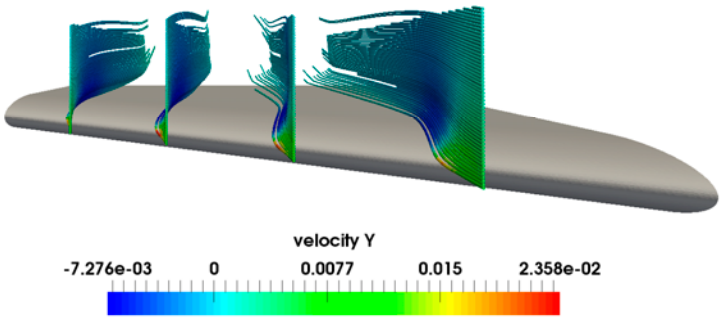

Fig. 2: Crossflow in swept-wing boundary layer

Publications

N/A

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	1 - 1280
Elapsed Time per Case	24 Hour(s)

- **Resources Used(JSS2)**

Fraction of Usage in Total Resources[*1](%): 0.08

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
SORA-MA	125,990.45	0.02
SORA-PP	83,753.28	0.66
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	361.60	0.33
/data	14,573.42	0.28
/ltmp	10,253.91	0.87

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2](%)
J-SPACE	1.50	0.05

[*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.

- **Resources Used(JSS3)**

Fraction of Usage in Total Resources[*1](%): 0.03

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	58,365.19	0.01
TOKI-RURI	2,103.13	0.01
TOKI-TRURI	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	352.06	0.24
/data	17,733.26	0.30
/ssd	405.31	0.21

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2](%)
J-SPACE	1.50	0.05

[*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.