Innovative Green Aircraft Technology (iGreen) : Riblet coating technology

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Abstract

By developing a particular riblet pattern that is effective at reducing the turbulence frictional resistance, and by producing and applying an easy-to-coat method that can create an optimum riblet surface on the airframe, reduce friction drag in the turbulence boundary layer.

Ref. URL: https://www.aero.jaxa.jp/eng/research/ecat/igreen/

Reasons and benefits of using JAXA Supercomputer System

CFD analysis are used for developing a particular riblet pattern that is effective at reducing the turbulence frictional resistance. Huge calculation resources and costs are required for the high fidelity and quick response CFD analysis for obtaining the optimum riblet pattern. Use of JSS is indispensable for these requirements; the cost and time on the CFD analysis are drastically saved.

Achievements of the Year

We have performed a series of direct numerical simulations of a turbulent channel flow over several blade-tyoe riblets for detemining an optimal shape of the riblet. Consequently, the effect of riblet shape and the dependence of S^+ (a riblet spacing normalzied by wall units) for a new riblet ragarding the drag reduction rate have been clarified.

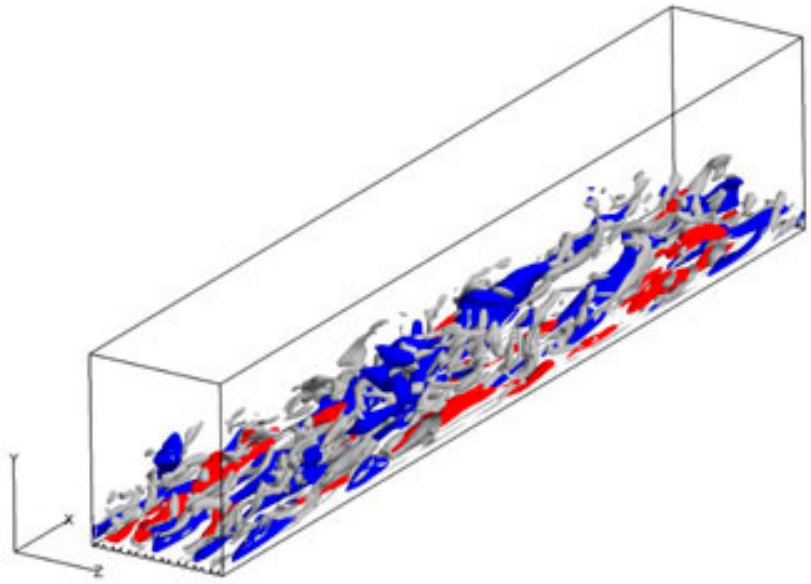

Fig. 1: Near-wall streaks and vortical structures in the riblet DNS. The white isosurfaces refer to positive values of the second invariant of the fluctuating velocity tensor, whereas the red and blue isocontours denote the positve and negative values of the streamwise velocity fluctuation.

Publications

N/A

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	Automatic Parallelization
Number of Processes	64 - 512
Elapsed Time per Case	500 Hour(s)

- **Resources Used(JSS2)**

Fraction of Usage in Total Resources[*1](%): 0.93

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
SORA-MA	5,647,044.30	1.07
SORA-PP	782.56	0.01
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	4.38	0.00
/data	9,828.13	0.19
/ltmp	634.77	0.05

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2](%)
J-SPACE	0.62	0.02

[*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](%): 0.30

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	1,630,607.27	0.35
TOKI-RURI	0.01	0.00
TOKI-TRURI	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	5.68	0.00
/data	9,847.38	0.17
/ssd	39.74	0.02

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2](%)
J-SPACE	0.62	0.02

[*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.