

FINE (Flight Investigation of skin-friction reducing Eco-coating)

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● Abstract

This study develops a more effective riblet pattern to reduce the skin friction in the turbulent boundary layer by using DNS. The optimized riblet pattern by the DNS is painted on a experiment airplane, the effects of the reducing skin friction is evaluated in flight.

<http://www.aero.jaxa.jp/eng/research/ecat/ecowing>

● Reasons for using of JSS2

CFD (DNS) analysis are used for developing a optimized riblet pattern that is effective to reduce the skin friction in turbulent boundary layer. Huge calculation resources and costs are required for the high fidelity and quick response CFD analysis for obtaining the optimum riblet pattern. Use of JSS2 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 riblets in order to understand the basic characteristics regarding the riblets for the flight testing in the 'FINE' project. Consequently, the performance of the riblets, i.e. a dependence of S^+ (a riblet spacing normalized by wall units) on the drag reduction, have been successfully clarified.

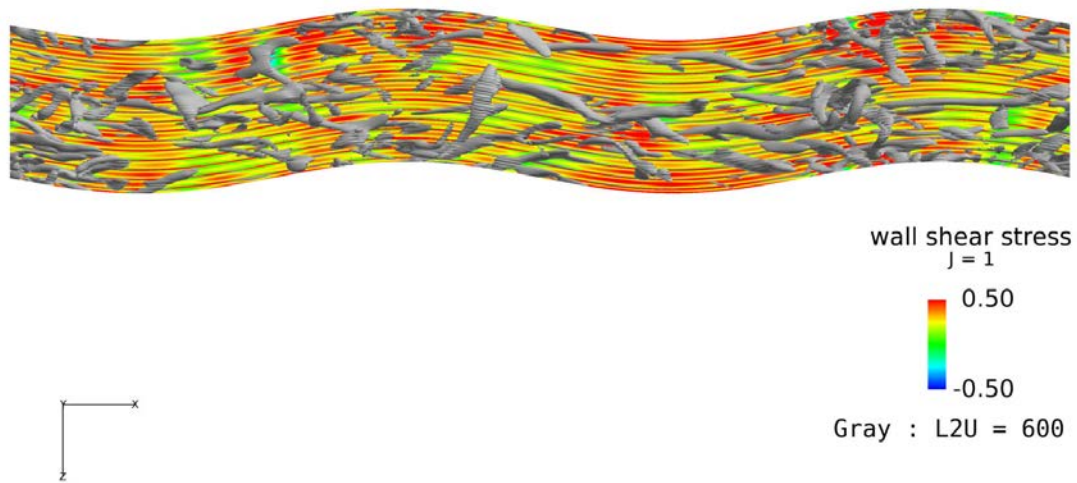


Fig.1 Vortical structures and wall shear stress in the DNS. Isosurfaces refer to positive values of the second invariant of the fluctuating velocity tensor, whereas the color contours show the wall shear-stress distribution.

● Publications

- Non peer-reviewed papers

- 1) Kurita, M., Nishizawa, A., Kwak, D., Iijima, H., Iijima, Y., Takahashi, H., Sasamori, M., Abe, H., Koga, S., Nakakita, K., Kuroda, F., "FINE: Flight Investigation of skiN-friction reducing Eco-coating, First Flight Test", 55th Aircraft Symposium, 2017.

● Usage of JSS2

● Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	Automatic Parallelizatio
Number of Processes	64 - 512
Elapsed Time per Case	500.00 hours

● Resources Used

Fraction of Usage in Total Resources*1 (%): 1.37

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	11,499,337.06	1.53
SORA-PP	84.29	0.00
SORA-LM	14.69	0.00
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage assigned(GiB)	Fraction of Usage*2 (%)
/home	006.34	0.00
/data	9,858.96	0.18
/ltmp	878.91	0.07

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	0.99	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