Research of laminar fin system

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Abstract

The laminar flow vertical tail fins are designed and evaluated to establish practical technology for a natural laminar flow wing that will be applied to future subsonic aircraft.Moreover, the surface roughness that can maintain the laminarization effect is evaluated.

Reasons and benefits of using JAXA Supercomputer System

In laminar airfoil design, which aims to reduce the fuel consumption of aircraft, rapid design is required. On the contrary, to analyze fine boundary layer flow, it is necessary to perform a large number of high-precision fluid analyses. For analysis of surface roughness, it is necessary to analyze the flow field in more detail than the design. Fluid analysis using a supercomputer is indispensable for carrying out these projects.

Achievements of the Year

In 2023, a demonstration of the effect of the laminar flow design in the high Reynolds number wind tunnel is planned. So a wind tunnel model for verification was designed. A wind tunnel test model applying the natural laminar flow concept was designed. It was designed considering the effects due to the absence of the horizontal stabilizer and the fuselage length. As a result, a wing shape that was predicted to have a very large laminar flow effect is obtained.

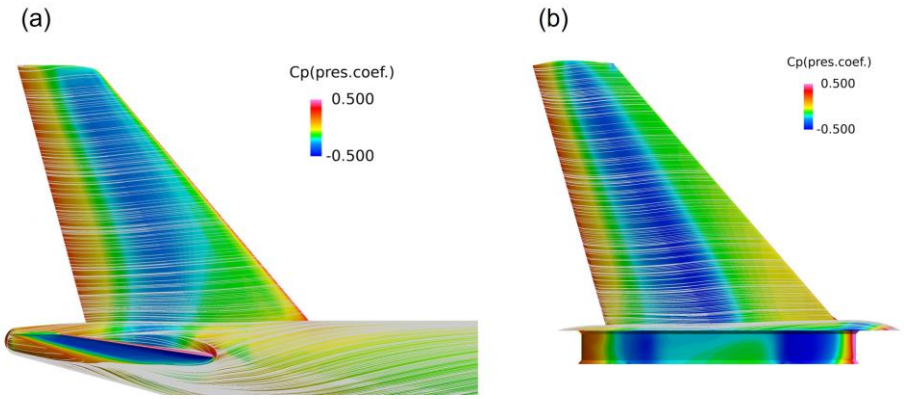

Fig. 1: Pressure distribution and surface streamline on vertical tail fin. (a) initial (not laminar) wing of full configuration, (b) laminar wing of wind tunnel model.

Publications

N/A

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	Automatic Parallelization
Number of Processes	48 - 7200
Elapsed Time per Case	36 Hour(s)

JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 1.31

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	33,272,471.05	1.45
TOKI-ST	155,017.48	0.15
TOKI-GP	0.00	0.00
TOKI-XM	20,163.03	12.61
TOKI-LM	15,723.56	1.05
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	90.37	0.08
/data and /data2	68,769.99	0.53
/ssd	2,105.28	0.29

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	18.51	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)	4,574.91	3.18

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