Innovation for Design, Data-acquisition, Trouble-shoot and Certification in Aircraft Development: Acceleration and accuracy improvement of aerodynamic modeling

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Abstract

The Aerodynamic Prediction Technology, which is a part of the Innovation for Design, Data-acquisition, Trouble-shoot and Certification in Aircraft Development, constructs the assist technologies to accelerate domestic aircraft development sequences using basic aerodynamic technologies. The target of the Aerodynamic Prediction Technology is paradigm shift from artisanal prediction to analytical one to accelerate domestic aircraft development sequences. This study aimes to improving a prediction accuracy of flow separation in a flight Reynolds number. Turbulance models for RANS simulation were modified to fit to experimental results from a high Reynold number wind tunnel by utilizing a data assimilation techniquie.

Reasons for using JSS2

The use of JSS2 was necessary for conducting a lot of CFD simulations in a short period for refining a shape of wind tunnel model and performing the data assimilation.

Achievements of the Year

A CFD parametric study on wing shape was conducted for selecting a wind tunnel model configuration, which had a simple and sensitive Reynolds number dependence on its trailing edge separation. The simulation data were utilized for the wind tunnel test model design. The wind tunnel experiment was produced good data with the Reynolds number dependence as expected by CFD predictions (Fig. 1).

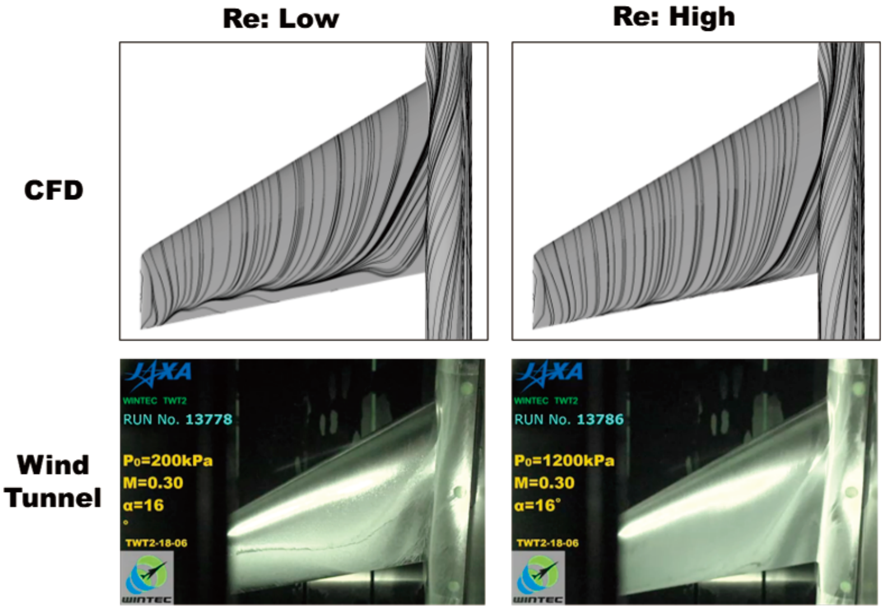

Fig. 1: Reynolds number dependence on flow separation

Publications

- Oral Presentations

Hajime Miki and Kazuyuki Nakakita, "Wind Tunnel Test Plan and Preliminary Experiment for Acquiring Characteristics of Flow Separation in High Reynolds Number Regimes", 50th Fluid Dynamics Conference, 3E08, 2018. (in Japanese)

Usage of JSS2

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	32 - 512
Elapsed Time per Case	20000 Second (s)

Resources Used

Fraction of Usage in Total Resources*1 (%): 0.06

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	546,089.72	0.07
SORA-PP	772.97	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	13.60	0.01
/data	3,580.05	0.06
/ltmp	1,483.45	0.13

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	0.00	0.00

*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.