

Aerodynamic Properties measured using magnetic suspension and balance system

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● Abstract

An aerodynamic model and its identification method for investigating the variations of the pitch dynamic derivatives of a delta-wing aircraft model with respect to the angle of attack (AOA) were proposed in this study. Wind tunnel tests were conducted during two maneuvers: steady pitch sweep and pitch sweep with an overlaid 1 Hz pitch oscillation. To subtract the forces and moments that act under no-wind conditions from balance data during wind tunnel tests, no-wind forces and moments were modeled using Gaussian basis functions. The extracted net aerodynamic forces and moments were processed to model and identify its characteristics using the dynamic derivative model.

● Reasons and benefits of using JAXA Supercomputer System

JAXA Supercomputer enables us to conduct unsteady CFD calculations.

● Achievements of the Year

Unsteady and steady RANS simulation of 2 oscillating aircraft models were conducted. One was a simple delta-winged model and the other was Standard Dynamics Model. The results for SDM model agreed well with Hashimoto's previous results.

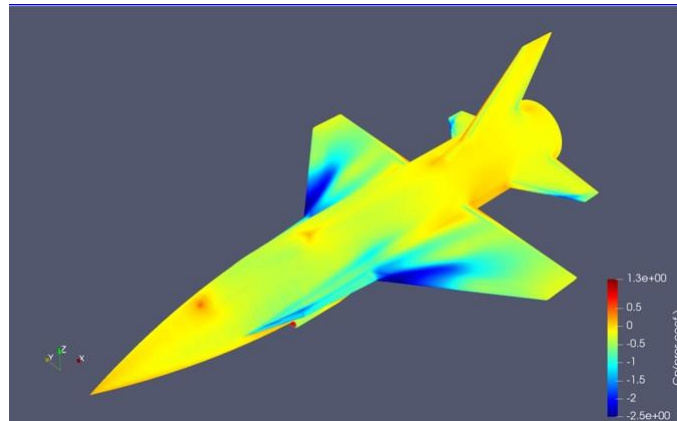


Fig. 1: Calculated CP Distribution (15-deg AOA, Fastar-MOVE)

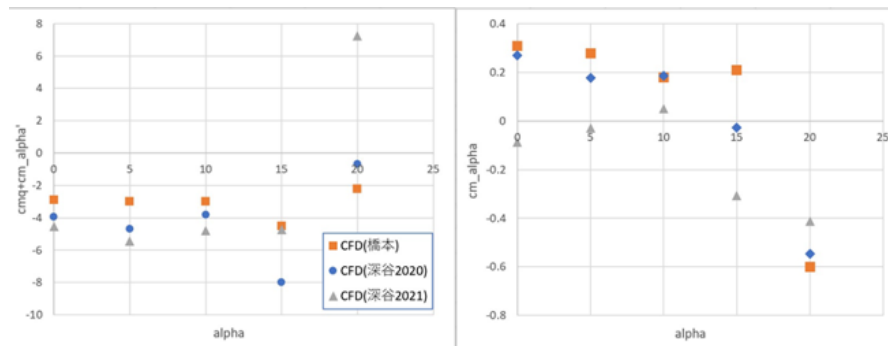


Fig. 2: Comparison of Pitch Stability Derivatives (between Current & Hashimoto's results)

● Publications

- Non peer-reviewed papers

Dissertation "Identification of Unsteady aerodynamic properties of delta-winged aircraft using magnetic suspension and balance system" by Daiki Kai, 2022.

- Oral Presentations

Fukaya,Sugiura,Kai,Tezuka,"Identification of Dynamic Derivatives of Rolling Standard Dynamics Model without Support Interference",Aircraft symposium 2021, 2C01.

Kai,Sugiura,Fukaya,Tezuka,"Identifying Dynamic Derivatives from Beat Vibration Data Using Magnetic Suspension Wind Tunnel",Aircraft symposium 2021, 3B07.

● Usage of JSS

● Computational Information

Process Parallelization Methods	N/A
Thread Parallelization Methods	N/A
Number of Processes	1
Elapsed Time per Case	4 Hour(s)

● JSS3 Resources Used

Fraction of Usage in Total Resources*1(%): 0.02

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage*2(%)
TOKI-SORA	12.20	0.00
TOKI-ST	139,275.86	0.17
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	78.60	0.01
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	20.00	0.02
/data and /data2	200.00	0.00
/ssd	200.00	0.05

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.

● **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage*2(%)
ISV Software Licenses (Total)	0.00	0.00

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