

JAXA-SUBARU Cooperative Research

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● Abstract

Compound helicopter is one of the next-generation rotorcraft to achieve high-speed flight. However, the increased drag due to the aerodynamic interaction between the rotor and the fixed-wing is one of the technology issues for this type of rotorcraft. The purpose of JAXA-SUBARU cooperative research is to clarify the amount of the drag increase and understand the interactive mechanism through wind-tunnel test and numerical simulation.

● Reasons and benefits of using JAXA Supercomputer System

There are many computational cases and the prior simulations for the wind-tunnel tests are required. To obtain simulation results efficiently, the supercomputer system is required.

● Achievements of the Year

Wind-tunnel testing and numerical simulations are conducted for three different wings as shown in Fig.1. In the wind-tunnel tests, the rotor-test-stand affects the measurements of the aerodynamic forces significantly. The test data are corrected referring to the numerical simulation result where only simpler models are included. Figure 2 shows the comparison of the lift-to-drag ratio between the corrected test data and the simulation result. The summation of the isolated rotor and winged-body and the combined rotor/winged-body are compared in Fig. 2. There remains some discrepancies between the results of the tests and simulations, however, the reduction ratios of the lift-to-drag ratios are in good agreement between both results. The lift-to-drag ratio of the combined rotor/winged-body decreases by about 20% compared with the summation of isolated results. It is clarified that the aerodynamic drag increases significantly due to the aerodynamic interaction between the rotor and wing.

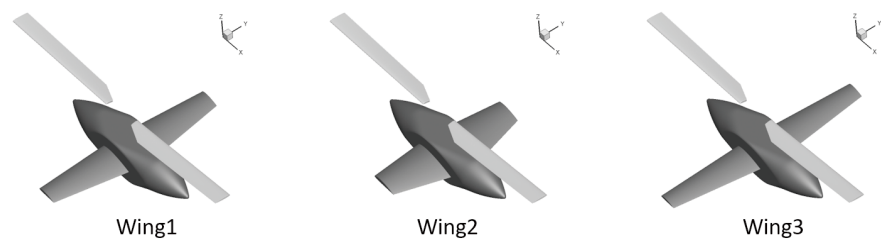


Fig. 1: Models of the combined rotor and winged-body

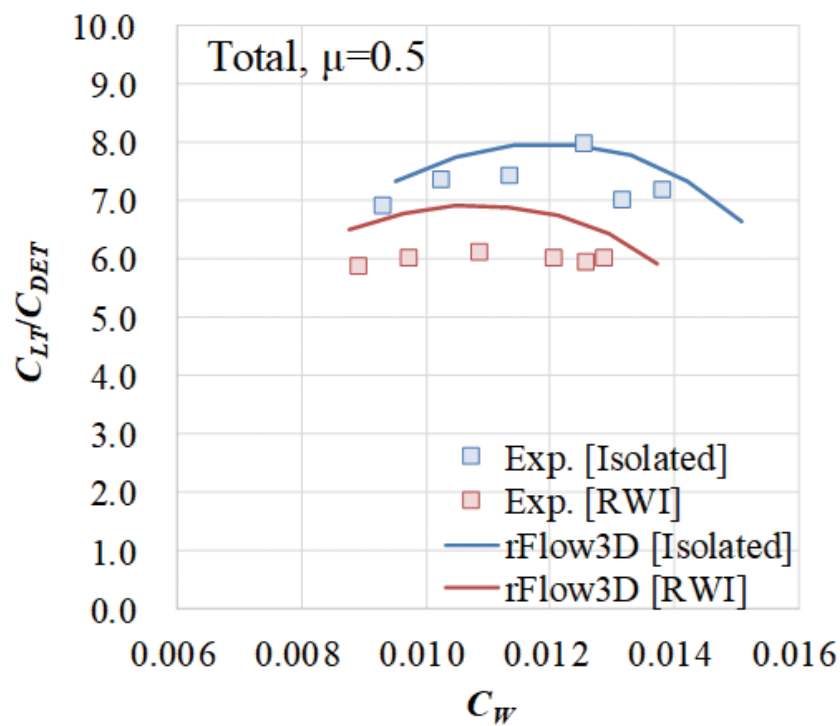


Fig. 2: Comparison of the results of the lift-to-drag ratio for the combined rotor/winged-body between the wind-tunnel test and the numerical simulation

● Publications

N/A

● Usage of JSS2

● Computational Information

Process Parallelization Methods	N/A
Thread Parallelization Methods	OpenMP
Number of Processes	1
Elapsed Time per Case	336 Hour(s)

● Resources Used

Fraction of Usage in Total Resources*1(%): 0.24

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2(%)
SORA-MA	49,563.41	0.01
SORA-PP	348,715.72	2.26
SORA-LM	3.84	0.00
SORA-TPP	162,833.95	9.83

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2(%)
/home	5,048.99	4.20
/data	16,667.34	0.29
/ltmp	4,764.44	0.40

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	7.94	0.20

*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.