

Computational analysis of compound helicopter

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● Abstract

The purpose of this study is to investigate aerodynamic interaction between the rotor and the winged-body of a compound helicopter using CFD analysis.

● Reasons and benefits of using JAXA Supercomputer System

The analysis of the aerodynamic interaction between the rotor and the winged-body using the helicopter aerodynamic analysis code rFlow3D is computationally intensive.

● Achievements of the Year

The effect of advance ratio on the aerodynamic interaction between main rotor and winged-body was investigated through numerical simulations. Figure 1 shows the computational grid. The rotation of the blades of main rotor were simulated by moving overlapped grid. This simulation was performed using rFlow3D which is developed by JAXA. Figure 2 shows the overview of flow field of the rotor and winged-body. As a result, the total aerodynamic performance of the compound helicopter reduced significantly at higher advance ratios.

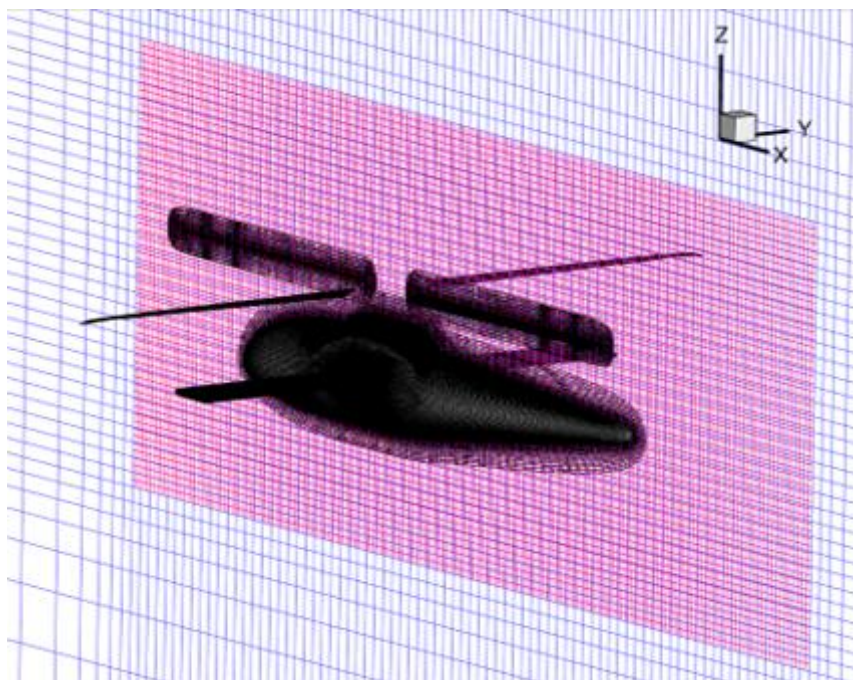


Fig. 1: Computational grid of main rotor and winged-body

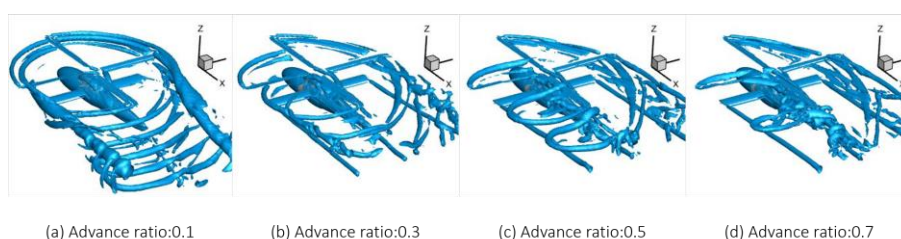


Fig. 2: Flow field of the rotor and winged-body

● Publications

- Oral Presentations

1)Hamamoto, Y., Akasaka, T., Tanabe, Y., Sugawara, H., Aerodynamic Interaction Between a Rotor and a Wing on Compound Helicopter in Forward Flights, the 53rd Fluid Dynamics Conference / the 39th Aerospace Numerical Simulation Symposium, Jun. 2021.

2)Hamamoto, Y., Akasaka, T., Tanabe, Y., Sugawara, H .,The Influence of Rotor/Wing Aerodynamic Interaction of Compound Helicopter in Forward Flights on Rotor,the 59th Aircraft Symposium, Dec. 2021.

● **Usage of JSS**

● **Computational Information**

Process Parallelization Methods	N/A
Thread Parallelization Methods	OpenMP
Number of Processes	1
Elapsed Time per Case	168 Hour(s)

● **JSS3 Resources Used**

Fraction of Usage in Total Resources*1(%): 0.62

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage*2(%)
TOKI-SORA	11,443.28	0.00
TOKI-ST	4,315,909.18	5.32
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	0.00	0.00
TOKI-TST	8.32	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	44.18	0.04
/data and /data2	18,454.51	0.20
/ssd	450.99	0.12

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)	210.96	0.15

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