High-speed rotorcrafts technology trainning

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Abstract

Analysis of the Effect of Lift Offset on Aerodynamical Characteristics of a Coaxial Rotor

Reasons and benefits of using JAXA Supercomputer System

In order to perform a rotorcraft analysis tool.

Achievements of the Year

Numerical analyses are performed using a rotorcraft CFD tool to research a coaxial rotor utilized in the next-generation rotorcraft. These numerical analyses aim to elucide the effect of rotor parameters on the aerodynamic performance of a coaxial rotor. The numerical results suggest that a rotor parameter, lift offset improves the rotor aerodynamic performance. Lift offset setting depending on the flight conditions can optimize the rotor efficiency. This effect is achieved by a slight increase in rotor drag and a huge reduction of rotor power.

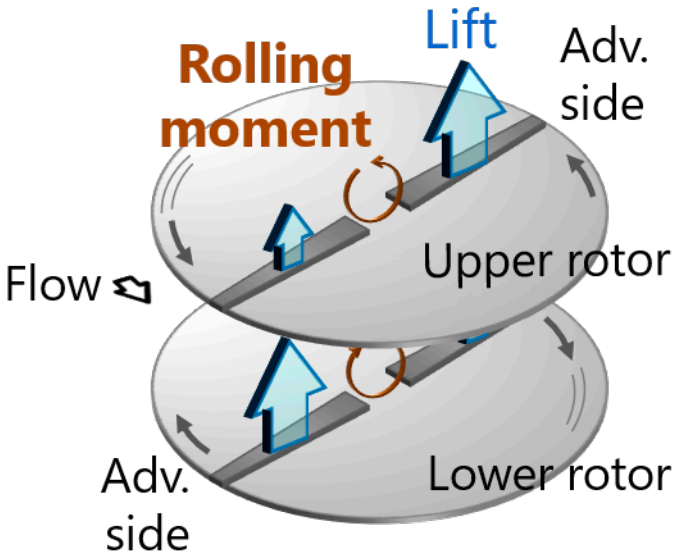

Fig. 1: The configuration of lift offset. Lift offset increases lift at the rotor advancing side. Rotor rolling moment due to the lift diffrence between the rotor advancing side and the retreating side is canceled by rotor counter-rotation. Lift offset is expressed by the ratio of the rotor rolling moment and the rotor thrust.

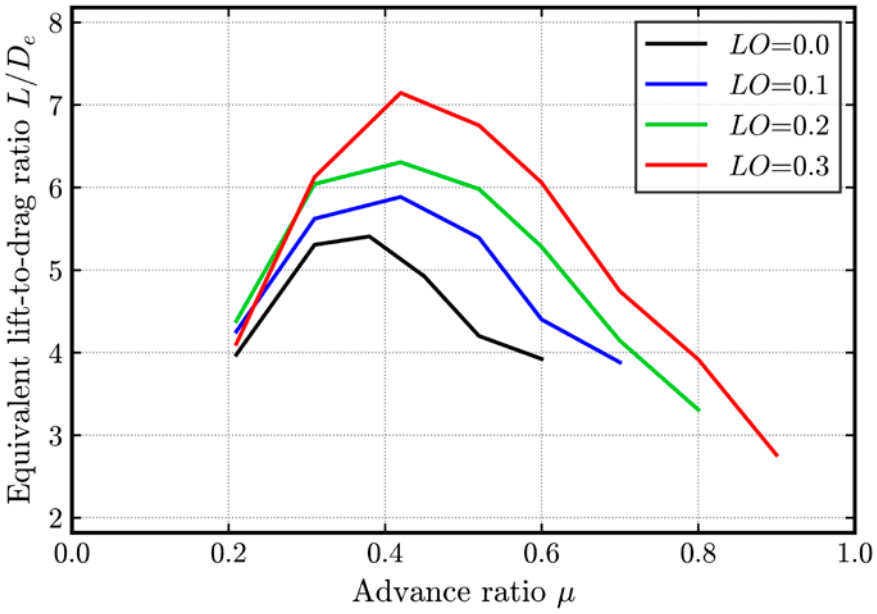

Fig. 2: The transition of equivalent lift-to-drag ratio of coaxial rotor against each advance ratio. Equivalent lift-to-drag ratio shows the aerodynamic performance of a rotor. The result suggests that lift offset (LO) improves equivalent lift-to-drag ratio.

Publications

- Non peer-reviewed papers

Hayami, K., Sugawara, H., Tanabe, Y., and Kameda, M., "Analysis of the Effect of Lift Offset on Aerodynamical Characteristics of a Coaxial Rotor.", 58th Aircraft Symposium, (2020).

- Oral Presentations

Hayami, K., Sugawara, H., Tanabe, Y., and Kameda, M., "Analysis of the Effect of Lift Offset on Aerodynamical Characteristics of a Coaxial Rotor.", 58th Aircraft Symposium, (2020).

Usage of JSS

Computational Information

Process Parallelization Methods	N/A
Thread Parallelization Methods	OpenMP
Number of Processes	1
Elapsed Time per Case	140 Hour(s)

- **Resources Used(JSS2)**

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	0.00	0.00
SORA-PP	34,240.92	0.27
SORA-LM	0.00	0.00
SORA-TPP	22,762.70	2.15

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	287.27	0.26
/data	12,292.40	0.24
/ltmp	2,280.92	0.19

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.

- **Resources Used(JSS3)**

Fraction of Usage in Total Resources[*1](%): 0.09

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	0.00	0.00
TOKI-RURI	131,684.72	0.75
TOKI-TRURI	699.53	0.06

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	287.27	0.20
/data	13,180.19	0.29
/ssd	546.60	0.29

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.