Numerical Simulations for Mutirotor

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Abstract

In multirotor aircraft such as drones and electric vertical take-off and landing aircraft (eVTOL aircraft), complex flowfields are produced by multiple rotors, which interfere with each rotorcraft component, affecting the aerodynamic performance ot rotorcraft. This work focuses on the phenomenon of aerodynamic interference in multirotors and conducts reseatch and development of methods to improve rotor performance and reduce performance degradation due to aerodynamic performance for eVTOL aircraft.

Reasons and benefits of using JAXA Supercomputer System

For aerodynamic analysis of a multirotor, it is necessary to capture complex flowfields and vortices, and large-scale analysis using a supercomputer is required.

Achievements of the Year

In multirotor aircrafts such as drones and electric vertical take-off and landing aircrafts (eVTOL aircrafts), complex flowfields are produced by multiple rotors, which interfere with each rotorcraft component, affecting the aerodynamic performance of rotorcraft. This work focuses on the phenomenon of aerodynamic interference in multirotors and investigates technologies to improve rotor performance for eVTOL aircraft.

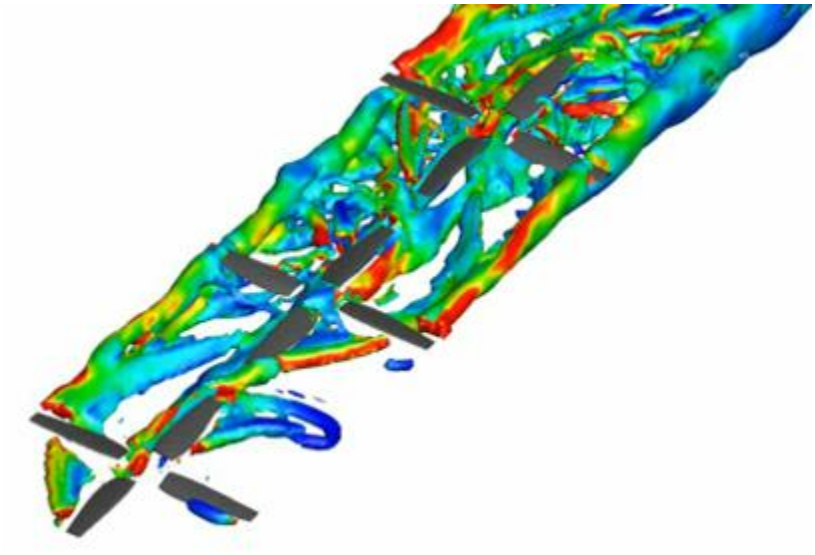

Fig. 1: Flowfield of complicated tip vorticites around the multirotor.

Publications

- Non peer-reviewed papers

(1)Saito, et. al, "Numerical Simulation of the Aerodynamic Interference between Multiple Rotors,"The 55th Fluid Dynamics Conference/The 41st Aerospace Numerical Simulation Symposium.

(2)Yumino, et. al, "Aerodynamic Performance Analysis of Multirotor with Multirotor Lift Offset (MRLO),", Aircraft Symposium 2023.

Usage of JSS

Computational Information

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

- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.12

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	0.00	0.00
TOKI-ST	912,084.60	0.98
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	0.00	0.00
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	305.43	0.25
/data and /data2	19,569.32	0.12
/ssd	3,129.13	0.30

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)	695.57	0.31

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