Research on the rotorcraft aerodynamics and noise prediction technologies

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Abstract

We aim at the development of aerodynamics and noise computation techniques for the rotorcrafts by extensively applying the unstructured-grid CFD code FaSTAR-Move that utilizes an overset moving grid approach. By using unsteady CFD data obtained by FaSTAR-Move, a fast noise propagation analysis tool that can involve noise-shielding effects is being developed as well.

Reasons and benefits of using JAXA Supercomputer System

In this research topic, real-scale complicated models must be computed with real flow conditions, which requires large computer resources and is suited to the use of the JAXA supercomputer system.

Achievements of the Year

In this fiscal year, we performed isolated rotating rotor blade analyses by FaSTAR-Move/rNoise coupling approach to identify the numerical schemes and grid arrangements suited to accurate noise predictions by comparing with experimental data. As isolated rotor configurations, we employed a HART-II helicopter model blade and a QTW propellor blade. Through the experimental data comparison, highly resolved convection schemes should be applied to noise prediction problems. However, an additional computation case of rotor-fuselage interaction analysis for the HART-II helicopter model, shows the discrepancy from the experiment and rFlow3D data. We will continue the research to determine this reason.

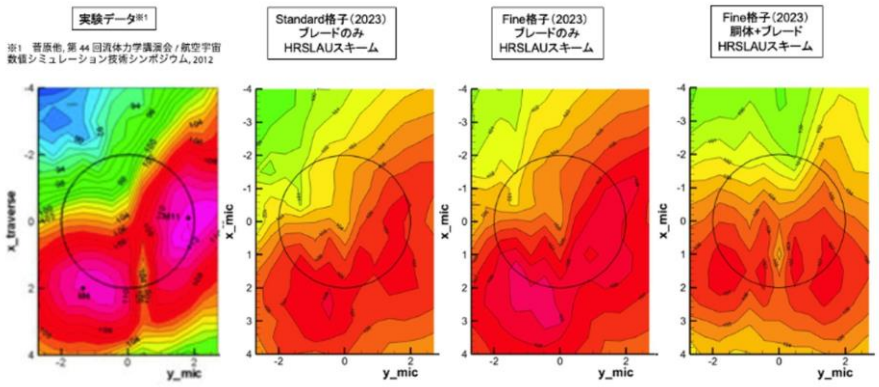

Fig. 1: Obtained results of HART-II model by FaSTAR-Move/rNoise coupling approach

Publications

- Oral Presentations

1) Kanako Yasue , Masatoshi Kanayama, Hideaki Sugawara and Yasutada Tanabe, "Study of Rotorcraft Noise Prediction Utilizing Unstructured CFD Solver," 55th Fluid Dynamics Conference / 41st Aerospace Numerical Simulation Symposium, 2023.

2) Kanako Yasue, Hiroki Ura, Hideaki Sugawara, Tomoaki Ikeda, Kazuyuki Nakakita, Kensuke Hayashi, Yoshimi Iijima, Tsutomu Nakajima, Yousuke Sugioka, Yuki Kishi, Yasutada Tanabe, Masahiko Sugiura, Keita Kimura and Noboru Kobiki, "Research Activities for Improving Social Acceptance of Advanced Air Mobility," 61st Aircraft Symposium, 2023.

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	96 - 960
Elapsed Time per Case	200 Hour(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.14

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	3,635,954.59	0.16
TOKI-ST	10,369.25	0.01
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	355.56	0.03
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	1,222.34	1.01
/data and /data2	129,632.34	0.80
/ssd	30,720.00	2.90

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2] (%)
J-SPACE	7.19	0.03

[*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)	75.57	0.03

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