

Research on High-Speed Rotorcraft Technology

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● Abstract

Aiming to achieve a flight speed as high as twice of the conventional helicopters, a new concept of compound helicopter is proposed. Key technologies such the system integration, remarkable reduction of the aerodynamic drag and optimized rotor design are investigated.

● Reasons for using JSS2

The newly proposed compound helicopter utilizes 4 rotor/propellers. CFD analysis involving the whole aircraft requires large amount of memories and long-time computations. Super-computers such as the JSS2 is a must infrastructure for this kind of research.

● Achievements of the Year

Wind-tunnel testing using the conceptual model of the proposed compound helicopter is carried out and basic aerodynamic data are obtained which will be used to validate the CFD analysis results. Also, rotor/wing interactions which contribute to a large amount of the aerodynamic drag of the whole aircraft are simulated and the drag increases due to the interaction are collected. The rotor optimization for high-speed flight is also underway. A photo of the conceptual model during wind-tunnel testing is shown in Fig. 1, and a sample of CFD simulation for the whole aircraft configuration is shown in Fig. 2.



Fig. 1: Photo of the conceptual model during wind-tunnel testing

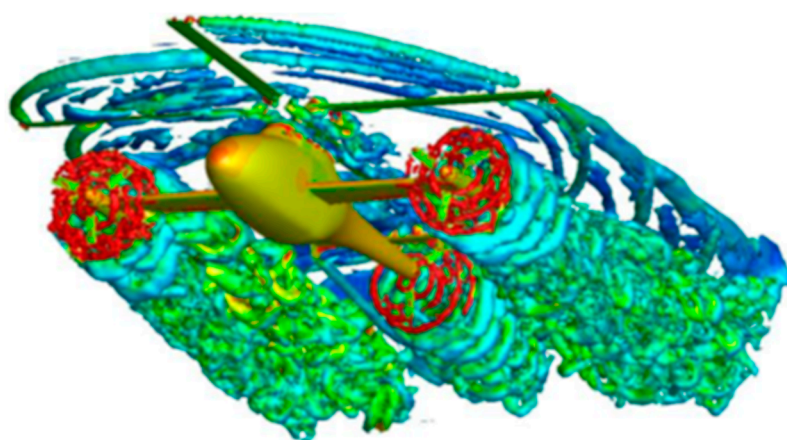


Fig. 2: A sample of the CFD simulation for a full-configuration of the conceptual model

● Publications

- Non peer-reviewed papers

1) Yasutada Tanabe, Masahiko Sugiura, Noboru Kobiki and Hideaki Sugawara, A New Concept of Compound Helicopter and Flight Tests, 2018 Asia Pacific International Symposium on Aerospace Technology, Chengdu, China, Oct 16-18, 2018.

2) Hideaki Sugawara, Yasutada Tanabe, Noriaki Itoga, Masaharu Kameda, Numerical Simulation of Aerodynamic Interaction Between a Rotor and a Wing, 7th Asian/Australian Rotorcraft Forum, Jeju Island, Korea, Oct 30 - Nov 1, 2018.

● Usage of JSS2

● Computational Information

Process Parallelization Methods	N/A
Thread Parallelization Methods	OpenMP
Number of Processes	1
Elapsed Time per Case	240 Hour (s)

● Resources Used

Fraction of Usage in Total Resources*1 (%): 0.77

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	1,221,581.65	0.15
SORA-PP	342,839.46	2.74
SORA-LM	0.00	0.00
SORA-TPP	464,168.85	33.95

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2 (%)
/home	133.51	0.14
/data	6,510.42	0.11
/ltmp	759.55	0.07

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.