Numerical Analyses on Hypersonic Experimental Aircraft

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Abstract

This research aims at the demonstration of the thrust control method of a hypersonic pre-cooled turbojet engine using liquid hydrogen fuel and the aircraft / propulsion integrated control method. We acquire the control characteristics of the hypersonic integrated control experiment aircraft to establish the aircraft / propulsion integrated control method taking into account the mutual interference of hypersonic airframe and hypersonic engines. In addition to defining the required specifications of hypersonic aircraft, we present the design specifications of the hypersonic experimental aircraft for carrying out flight demonstration of hypersonic pre-cooled turbojet engine.

Reasons for using JSS2

We need a long calcularion time to obtaine the aerodynamic characteristics of the overall hypersonic experimental aircraft by CFD analyses.

Achievements of the Year

Aerodynamic performances of the High Mach Integrated Control Experimental Aircraft (HIMICO) was evaluated by CFD analyses. (Fig. 1, Fig. 2, Fig. 3, Fig. 4)

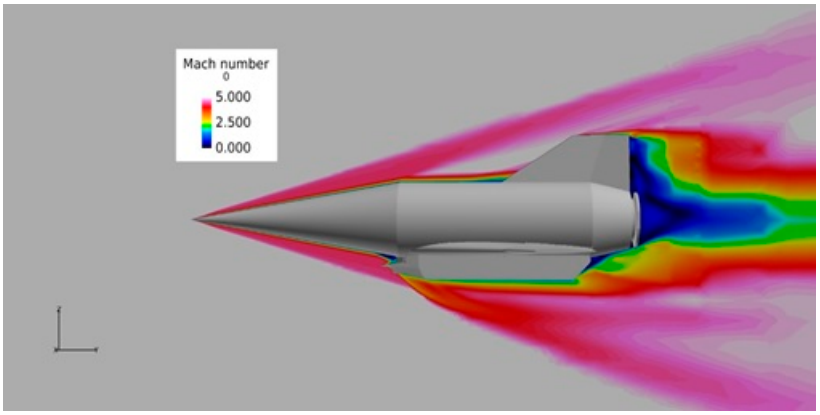

Fig. 1: High Mach Integrated Control Experiment (HIMICO) Vehicle (HIMICO 1, Mach Contour, Mach5, AoA = 0deg)

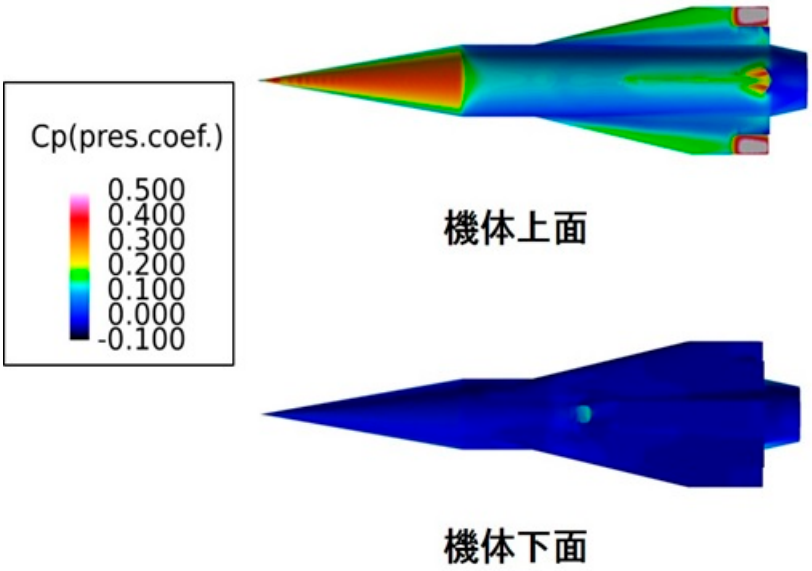

Fig. 2: High Mach Integrated Control Experiment (HIMICO) Vehicle with 15deg of elevator angle (HIMICO 2, Cp Countour, Mach5, AoA = -15deg)

Fig. 3: High Mach Integrated Control Experiment (HIMICO) Vehicle with 15deg of elevator angle (HIMICO 2, Streamline, Mach5, AoA = -15deg)

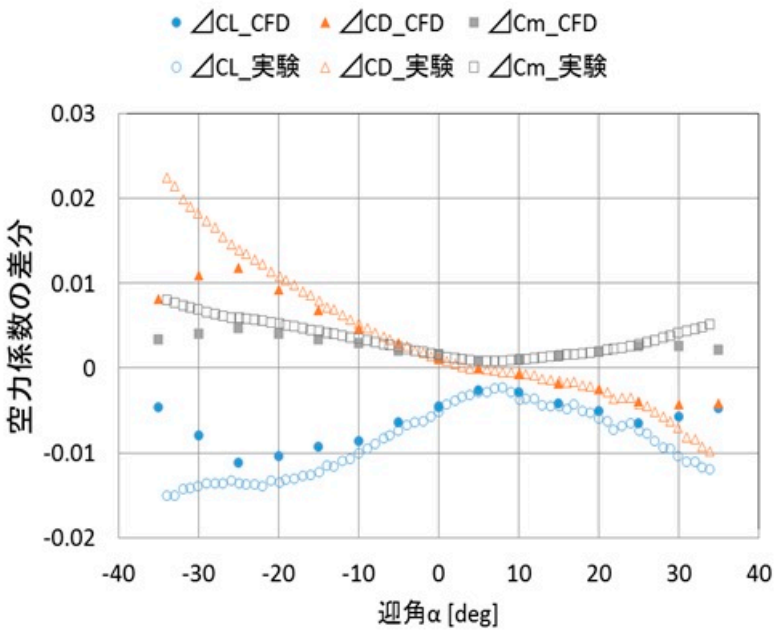

Fig. 4: High Mach Integrated Control Experiment (HIMICO) Vehicle with 15deg of elevator angle (HIMICO 2, Mach Contour and Streamline, Vertical Three-Component Force Compared with Wind Tunnel Test, Mach5)

Publications

- Non peer-reviewed papers

1) Uji, M., Taguchi, H., Hirotani, T., Hongoh, M., Tezuka, A., “Evaluation of Flow Field around Flight Control Surfaces of High-Mach Integrated Control Experiment (HIMICO) Vehicle,” 56th Aircraft Symposium, 2018.

- Oral Presentations

1) Uji, M., Taguchi, H., Hirotani, T., Hongoh, M., Tezuka, A., “Evaluation of Flow Field around Flight Control Surfaces of High-Mach Integrated Control Experiment (HIMICO) Vehicle,” 56th Aircraft Symposium, 2018.

Usage of JSS2

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	1 - 2
Elapsed Time per Case	30 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	6,703,794.51	0.82
SORA-PP	4,121.21	0.03
SORA-LM	3,514.47	1.64
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2 (%)
/home	2,145.77	2.22
/data	63,476.59	1.12
/ltmp	8,789.07	0.75

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.