Integrated Simulation over aircraft, rotorcraft and engines

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Abstract

In this study, with the aim of shortening the development period and reducing costs in aircraft development, we are conducting research and development on advanced Model-Based Development (MBD: Model-Based Development) and Model-Based Systems Engineering (MBSE) collaboration technologies with MBD Due to the reorganization of research cards, this fiscal year, we are conducting research and development focused on engine analysis technology under this project code.

As part of the research and development of engine analysis technology, we are conducting research on the advancement of the Cartesian grid CFD solver HINOCA-AE and the Many-block method, which is a unstructured grid method.

Ref. URL: https://www.aero.jaxa.jp/eng/research/basic/numerical/

Reasons and benefits of using JAXA Supercomputer System

JSS is necessary to complete large scale numerical simulations of unsteady phenomena and to understand it in short time span.

Achievements of the Year

As a primary achievement of this project code, we conducted the enhancement of the combustion model implemented in HINOCA-AE. Specifically, we implemented the Flamelet Progress Variables (FPV) method and confirmed that it allows for valid analyses in model combustors and lab-scale burners.

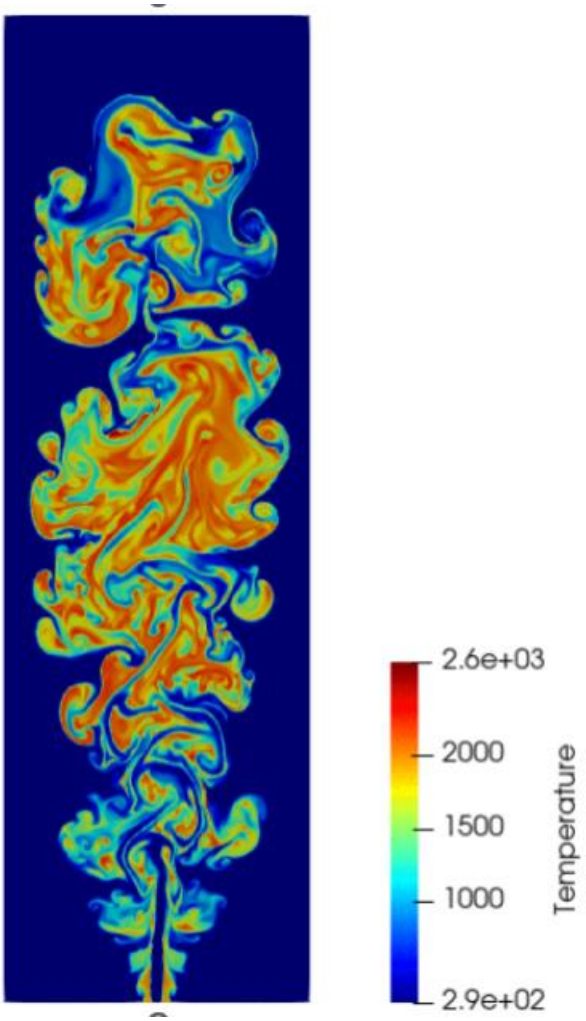

Fig. 1: An example computational result of a gas fuel burner using the FPV method.

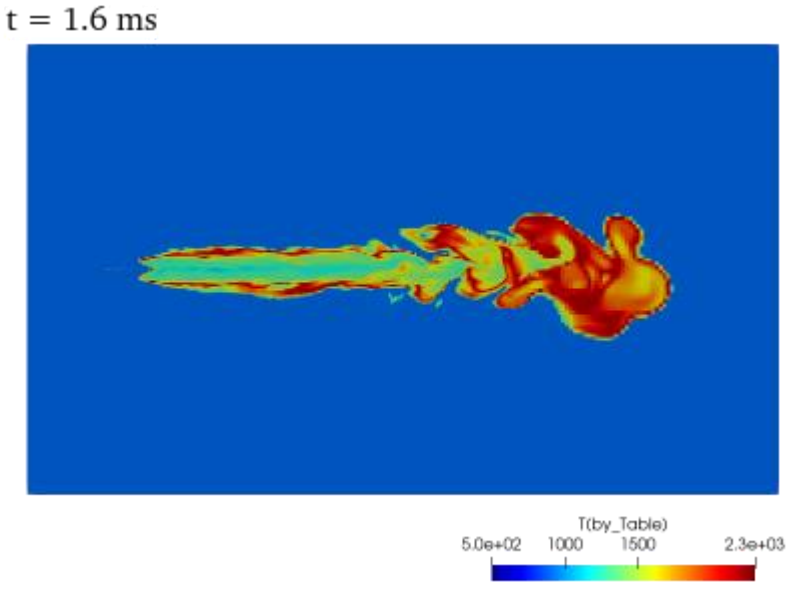

Fig. 2: An example computational result of a diesel combustion using the FPV method.

Publications

- Invited Presentations

Research and development of HINOCA, a thermo-fluid analysis program for automotive and aircraft engines

～High-performance computing in real-world machine analysis, including multi-physics and complex geometry～,

HPC Asia

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	1 - 8192
Elapsed Time per Case	480 Hour(s)

JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 1.01

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	27,290,905.38	1.23
TOKI-ST	8,161.24	0.01
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	5,219.23	0.40
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	1,456.11	1.21
/data and /data2	151,424.25	0.93
/ssd	33,391.09	3.15

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	11.40	0.04

*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)	183.38	0.08

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