Development of 3D CFD core-software of automotive engine combustion chamber

Report Number: R24EDA201N11
Subject Category: Aeronautical Technology
URL: https://www.jss.jaxa.jp/en/ar/e2024/27178/

Responsible Representative

MizobuchiYasuhiro, Project manager, Aviation Technology Directrate, XANADU Project Team

Contact Information

Taisuke Nambu, Aviation Technology Directorate, Fundamental Aeronautics Research Unit
(nambu.taisuke@jaxa.jp)

Members

Hiroyuki Abe, Atsushi Fujino, Ryohei Kirihara, Takuhito Kuwabara, Daiki Miyai, Taisuke Nambu, Daichi Obinata, Kei Shimura, Shogo Yasuda, Hiroki Yao

Abstract

Enhancing CAE utilization in automotive engine research through the development of a shared engine combustion simulation software for the Japanese automotive research community.

Reasons and benefits of using JAXA Supercomputer System

Massive-parallel large scale simulation, Large number of simulations fo software validation

Achievements of the Year

To make the HINOCA thermal-fluid analysis software for automotive engines, developed under this business code, more practical, we have set five key themes to enhance its functionality further:

1. Advancement of cell-based AMR method
2. Flux correction method at AMR boundaries
3. Enhancement of coupled analysis with heat conduction simulations
4. Improvement of extinction modeling
5. Implementation of features to enhance usability

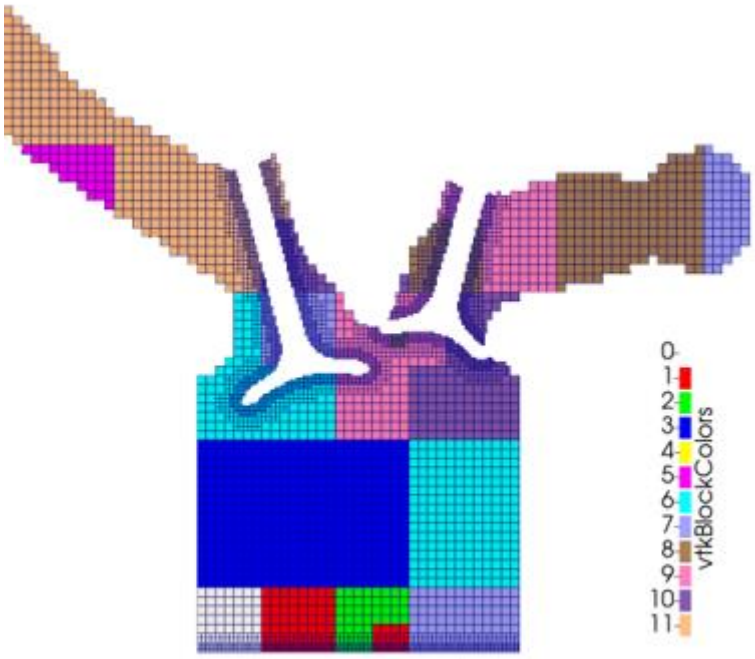

Fig. 1: An example of grid generation for an automotive engine combustion chamber using cell-based AMR

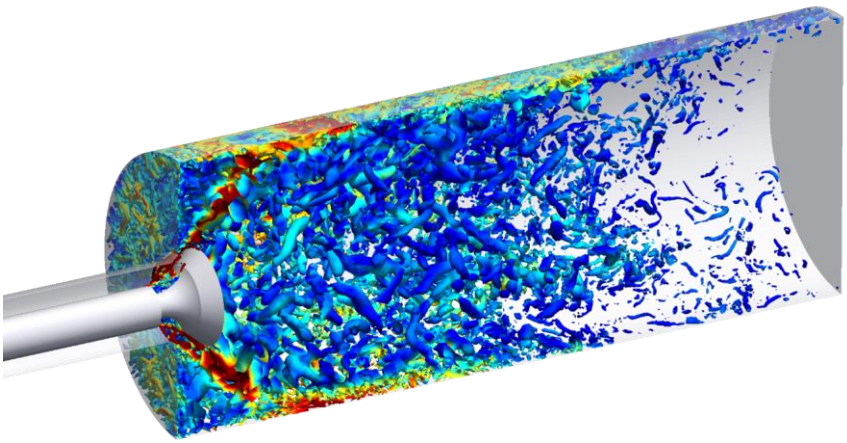

Fig. 2: An example of flow field analysis in a combustion chamber using cell-based AMR and a high-order accuracy analysis scheme

Publications

- Oral Presentations

Taisuke Nambu, Hiroki Yao, Takuhito Kuwabara, Ryohei Kirihara and Yasuhiro Mizobuchi, Research and Development of a Combustion Flow Analysis Program for Reciprocating Engines Using the Cartesian Grid and an Immersed Boundary Method,19th International Conference of Numerical Combustion

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	1 - 2048
Elapsed Time per Case	168 Hour(s)

JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 0.66

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	16,079,773.17	0.74
TOKI-ST	109,994.83	0.11
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	414.31	0.28
/data and /data2	488,563.39	2.34
/ssd	2,769.95	0.15

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	31.53	0.10

*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)	165.75	0.11

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