

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

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### ● Responsible Representative

MIZOBUCHI Yasuhiro, Senior researcher, Aviation Technology Directorate, Aircraft Lifecycle Innovation Hub

### ● Contact Information

MIZOBUCHI Yasuhiro, Japan Aerospace Exploration Agency, Aviation Technology Directorate(mizobuchi.yasuhiro@jaxa.jp)

### ● Members

Hiroyuki Abe, Atsusi Fujino, Manabu Hisida, Ryohei Kirihara, Takuhito Kuwabara, Yasuhiro Mizobuchi, Taisuke Nambu, Daichi Obinata, Kei Shimura, Shogo Yasuda, Hiroki Yao

### ● Abstract

Enhancement of CAE utilization in automotive engine research by developing an engine combustion simulation software that is sharable in Japan automotive research community.

### ● Reasons and benefits of using JAXA Supercomputer System

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

### ● Achievements of the Year

Computational time of firing simulation has been reduced to 1/2 by the concurrent execution of the dynamic AMR(Adaptive Mesh Refinement) around valves and the dynamic AMR around a piston. The figure shows the AMR block patterns and the flowfield in intake, fuel injection, flame propagation and exhaust timings where the AMR level around the piston is 2, and the maximum AMR level around the valves is 3.

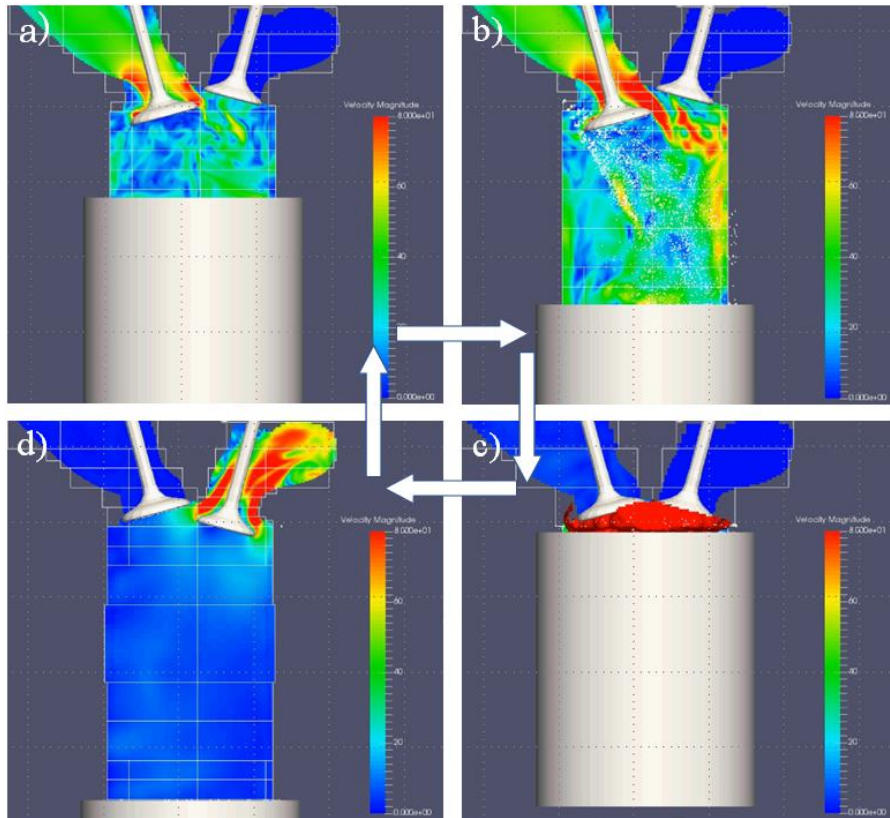


Fig. 1: Firing simulation by concurrent dynamic AMR around valves and piston.

● **Publications**

- Invited Presentations

MIZOBUCHI Yasuhiro, "Combustion analysis software HINOCA, past and future," "EXA scale computing from K to Fugaku," JSME CMD2021 forum, Sept. 23rd 2021.

● **Usage of JSS**

● **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	1 - 1200
Elapsed Time per Case	100 Hour(s)

● **JSS3 Resources Used**

Fraction of Usage in Total Resources\*1(%): 1.29

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage*2(%)
TOKI-SORA	29,472,964.91	1.43
TOKI-ST	307,631.14	0.38
TOKI-GP	0.00	0.00
TOKI-XM	128.23	0.09
TOKI-LM	133.46	0.01
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	1,001.99	1.00
/data and /data2	523,625.33	5.60
/ssd	6,899.22	1.78

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	67.01	0.45

\*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 <sup>*2</sup> (%)
ISV Software Licenses (Total)	466.04	0.33

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