

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

Report Number: R20EDA201N11

Subject Category: Aeronautical Technology

URL: <https://www.jss.jaxa.jp/en/ar/e2020/14319/>

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● 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 fo software validation

● Achievements of the Year

Computational time of mortoring simulation has been reduced to 1/2 by the implementation of dynamic AMR(Adaptive Mesh Refinement) procedure and the enhancement of inner iteration convergency of implicit time integration. The figure shows the AMR patterns depending on the states of the intake and exhaust valves.

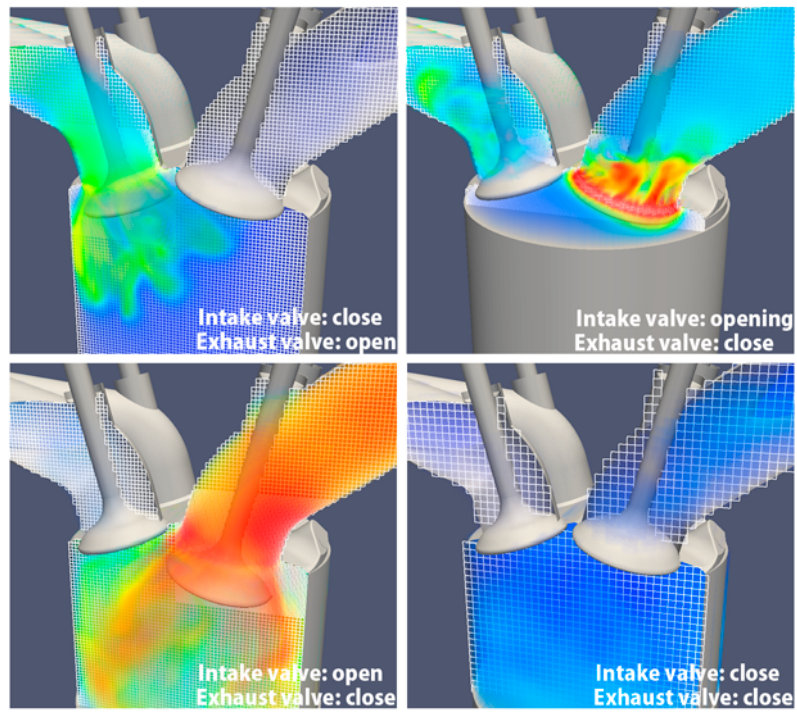


Fig. 1: AMR patterns depending on the states of the intake and exhaust valves.

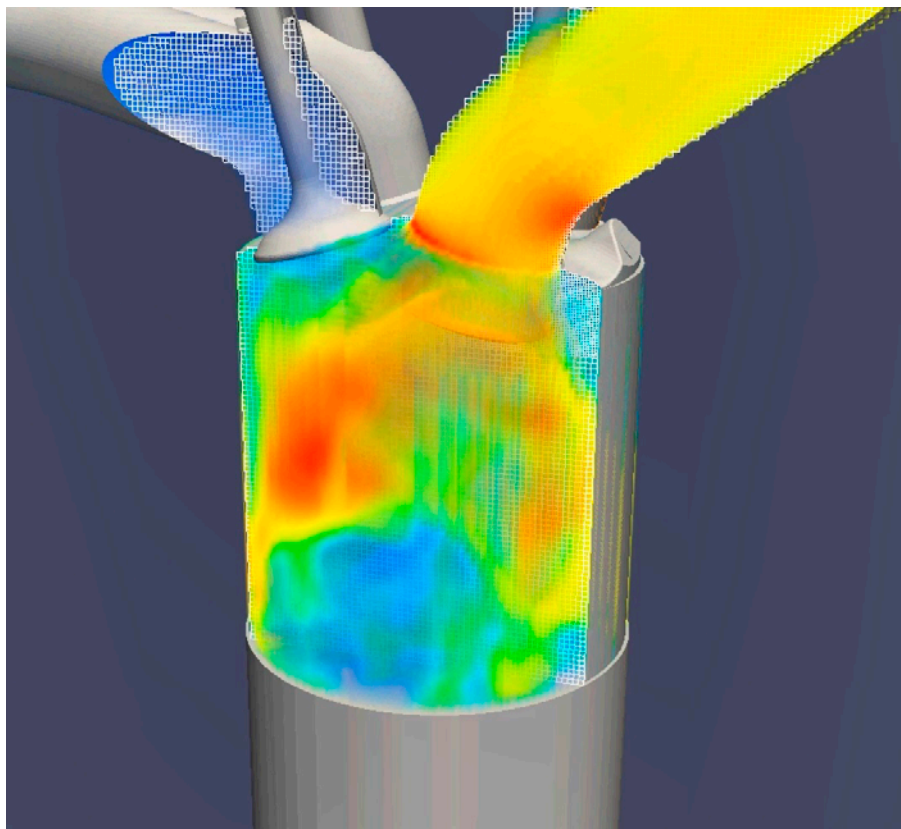


Fig. 2: Motoring simulation by dynamic AMR. (Video. Video is available on the web.)

● **Publications**

- Peer-reviewed papers

Yao, H., Nambu, T., Mizobuchi, Y., "An immersed boundary method for practical simulations of high-Reynolds number flows by k-e RANS models," Journal of Fluid Science and Technology Vol. 16 No.1 (2020).

● **Usage of JSS**

● **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	1 - 1200
Elapsed Time per Case	500 Hour(s)

● **Resources Used(JSS2)**

Fraction of Usage in Total Resources*1(%): 1.03

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2(%)
SORA-MA	4,124,837.23	0.78
SORA-PP	63,324.07	0.50
SORA-LM	5,434.70	3.19
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2(%)
/home	1,263.60	1.16
/data	464,320.66	8.97
/ltmp	7,835.64	0.67

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage ^{*2} (%)
J-SPACE	48.93	1.62

*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.

- **Resources Used(JSS3)**

Fraction of Usage in Total Resources^{*1}(%): 1.52

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage ^{*2} (%)
TOKI-SORA	6,342,111.24	1.36
TOKI-RURI	71,175.48	0.41
TOKI-TRURI	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage ^{*2} (%)
/home	2,054.11	1.41
/data	489,448.15	8.20
/ssd	2,867.79	1.50

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage ^{*2} (%)
J-SPACE	48.93	1.62

*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.