

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

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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(Fig.1) has been reduced to 1/3 by the improvement of BAMR(Block-based Adaptive Mesh Refinement) procedure, the acceleration of gas property calculation and the enhancement of inner iteration convergency of implicit time integration. Figure 2 shows the flame structure in combusiton simulation with BAMR.

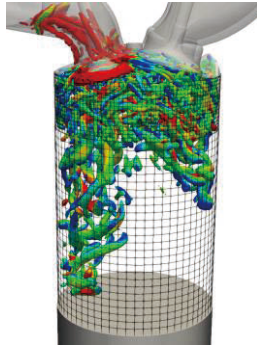


Fig. 1: Mortoring simulation with BAMR(Vortex structure).

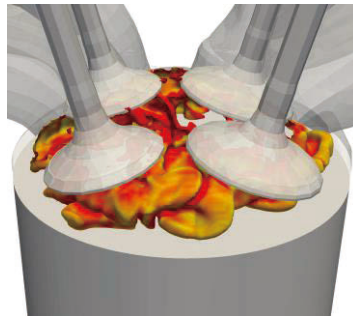


Fig. 2: Firing simulation with BAMR(Flame structure).

● Publications

- Invited Presentations

Functional design and platform: "Introduction and recent methodological progress," 2019 JSAE Annual Congress(Spring).

Yasuhiro Mizobuchi, Taisuke Nambu, Hiroki Yao, "Platform of Combustion Simulation Software HINOCA," ICFD2019.

- Oral Presentations

Hiroki Yao, Taisuke Nambu, Yasuhiro Mizobuchi, "Improvement for the immersed boundary method toward accurate internal flow simulations," ANSS2019.

Hiroki Yao, Taisuke Nambu, Yasuhiro Mizobuchi, "Improvements of the Immersed Boundary Method for High Reynolds Number Flow with Complex Geometries and its Application to Internal Flow Simulations," 33rd CFD Symposium.

- Usage of JSS2

- Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	1 - 256
Elapsed Time per Case	100 Hour(s)

- Resources Used

Fraction of Usage in Total Resources*1(%): 1.31

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2(%)
SORA-MA	10,061,932.97	1.22
SORA-PP	85,300.30	0.55
SORA-LM	2,774.84	1.16
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2(%)
/home	4,679.09	3.90
/data	496,445.70	8.50
/ltmp	32,704.40	2.78

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	69.88	1.76

*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.