Fundamental numerical analysis on propagation of detonation

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Abstract

For fundamental study on propagation of detonation waves inside rotating detonatio engines, fundamental numerical analysis using CHARIOT was done. In FY2022, 2D numerical analysis on propagation of detonation waves inside a rotating detonation engine with C2H4/O2 and H2/AIR mixture gases have been calucurated.

Ref. URL: http://www.mzkklab.com

Reasons and benefits of using JAXA Supercomputer System

Even for fundamental numerical analysisi on propagation of detonation waves, huge computational resources and high-performance CPU must be needed due to high-speed propagation and numerous erementaly reactions. JAXA's JSS3 has enough capability to carry out numerical analysis for detonation research. Therefore, our reserach need to perform the analysis with JSS3.

Achievements of the Year

Pressure distribution inside RDE combuster.

Temperature distribution inside RDE combuster.

The relation between equivalent ratio and peak pressure behind detonation wave.

The relation between equivalent ratio and peak temperature behind detonation wave.

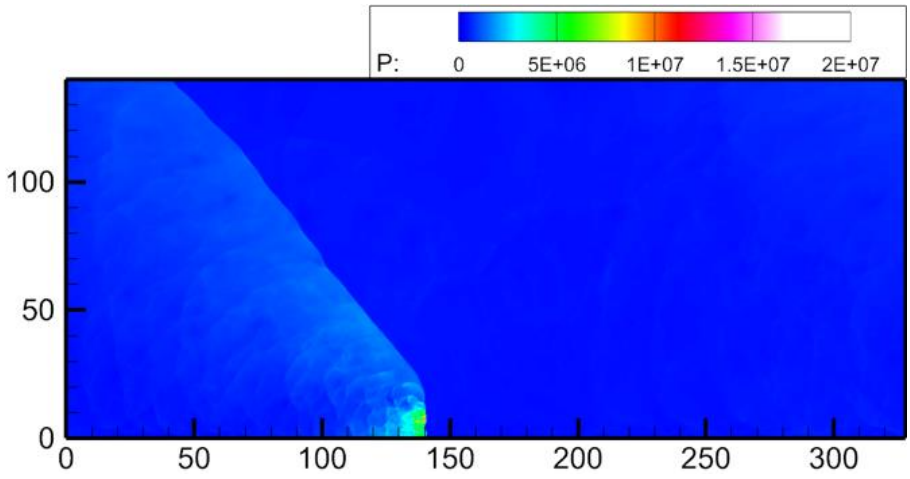

Fig. 1: Pressure distribution inside RDE combuster.

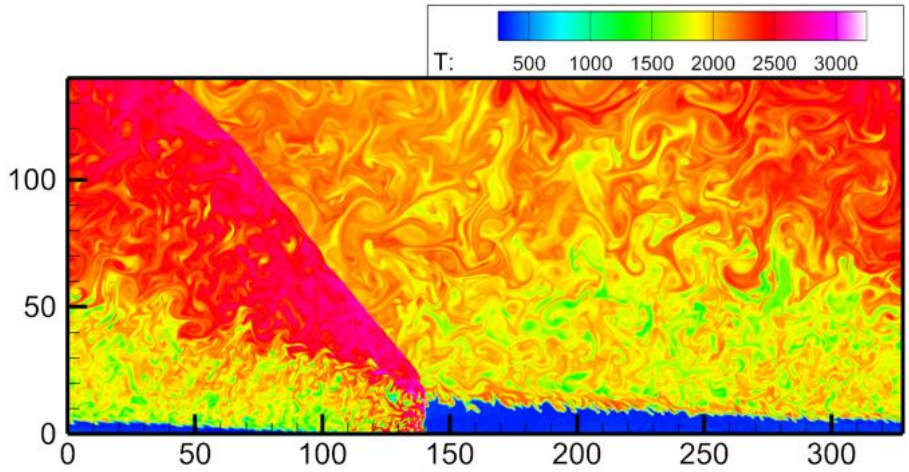

Fig. 2: Temperature distribution inside RDE combuster.

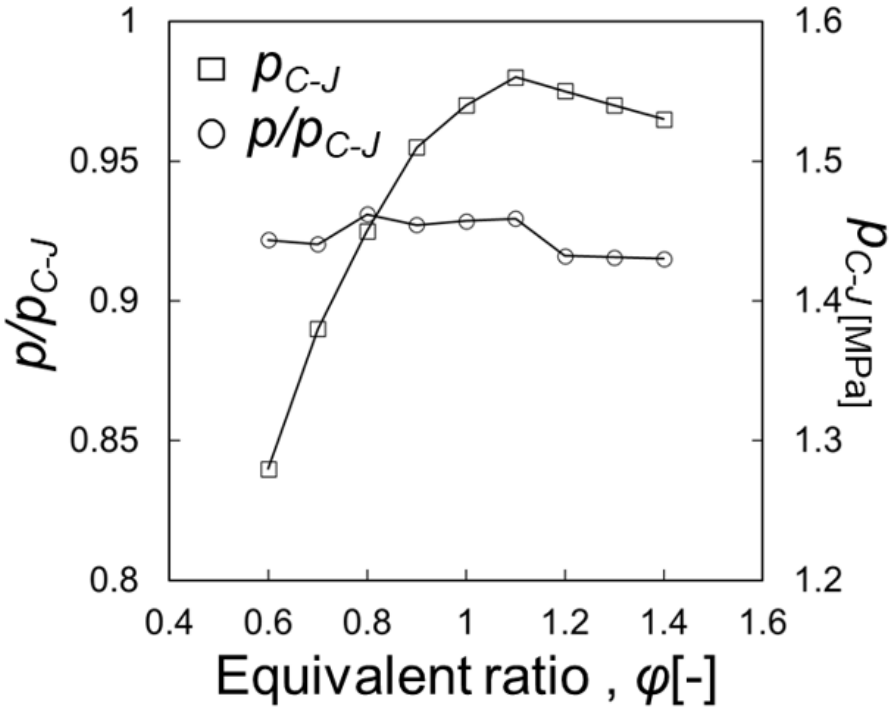

Fig. 3: The relation between equivalent ratio and peak pressure behind detonation wave.

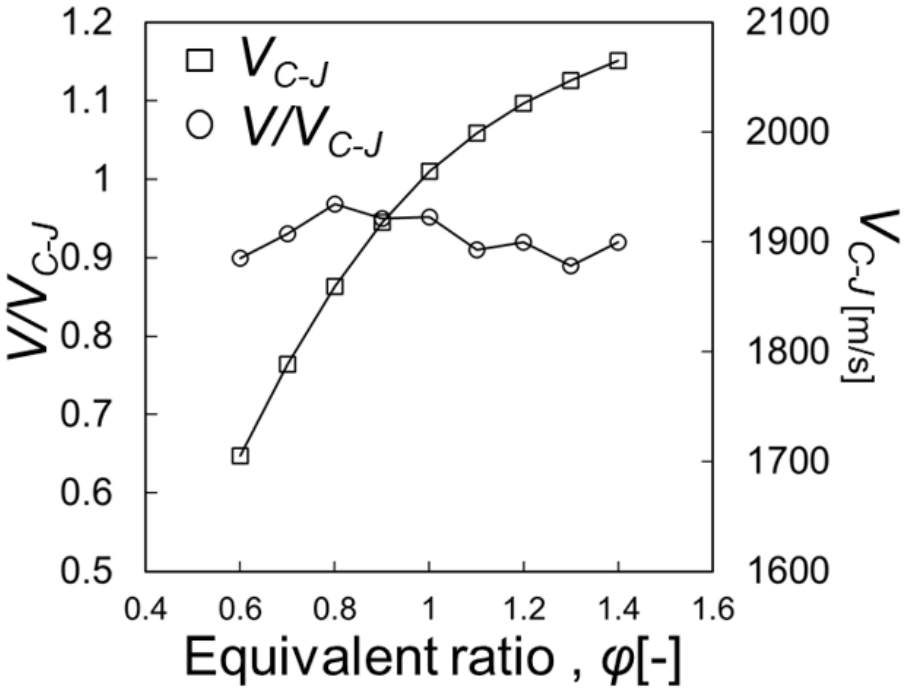

Fig. 4: The relation between equivalent ratio and peak temperature behind detonation wave.

Publications

N/A

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	20 - 100
Elapsed Time per Case	217922.4 Hour(s)

JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 0.05

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	1,409,033.60	0.06
TOKI-ST	0.00	0.00
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	245.00	0.20
/data and /data2	5,070.00	0.03
/ssd	0.00	0.00

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	0.00	0.00

*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)	0.00	0.00

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