

Fadamental numerical analysis on detonation propagation

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● Abstract

For fundamental study on propagation of detonation waves inside rotating detonatio engines, fundamental numerical analysis using CHARLOT 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.

● 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

Two-dimensional numerical analysis of detonation waves propagating in combustible jet trains. (Figures 1 and 2)

Two-dimensional numerical analysis of a rotating detonation engine using ethylene oxygen. (Fig. 3)

Two-dimensional numerical analysis of a rotating detonation engine using hydrogen air. (Fig. 4)

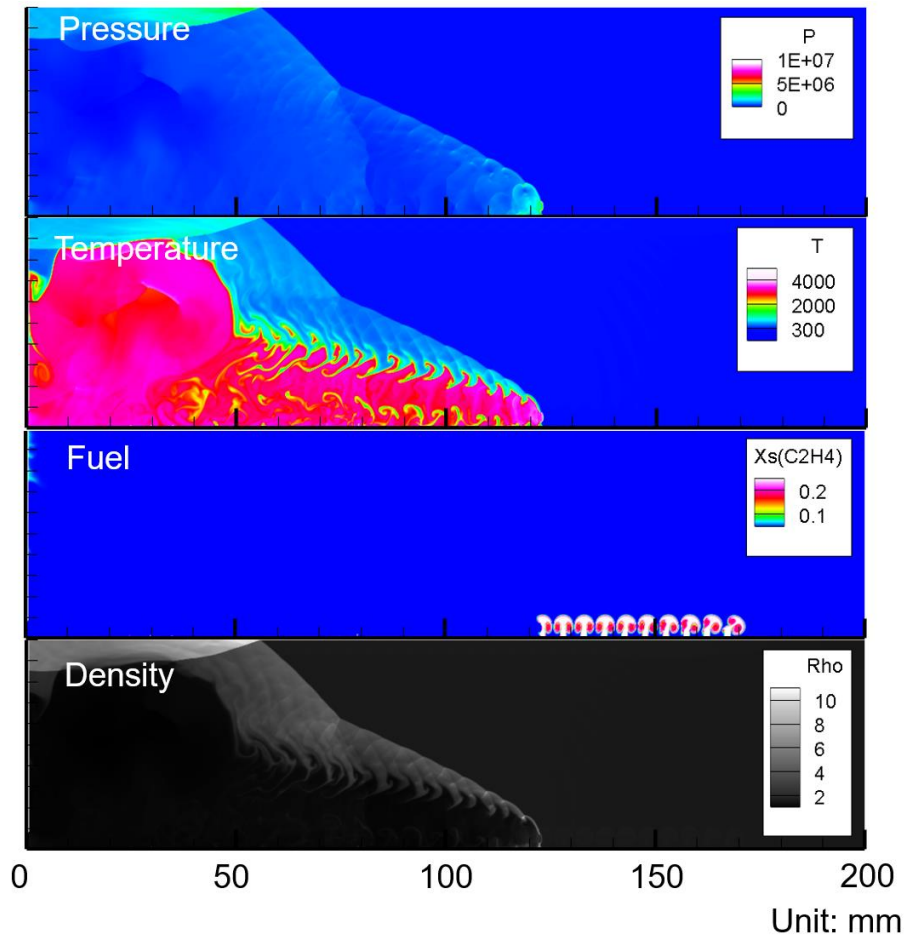


Fig. 1: Two-dimensional numerical analysis of detonation waves propagating in combustible jet trains. (Ethylene Oxygen premixed)

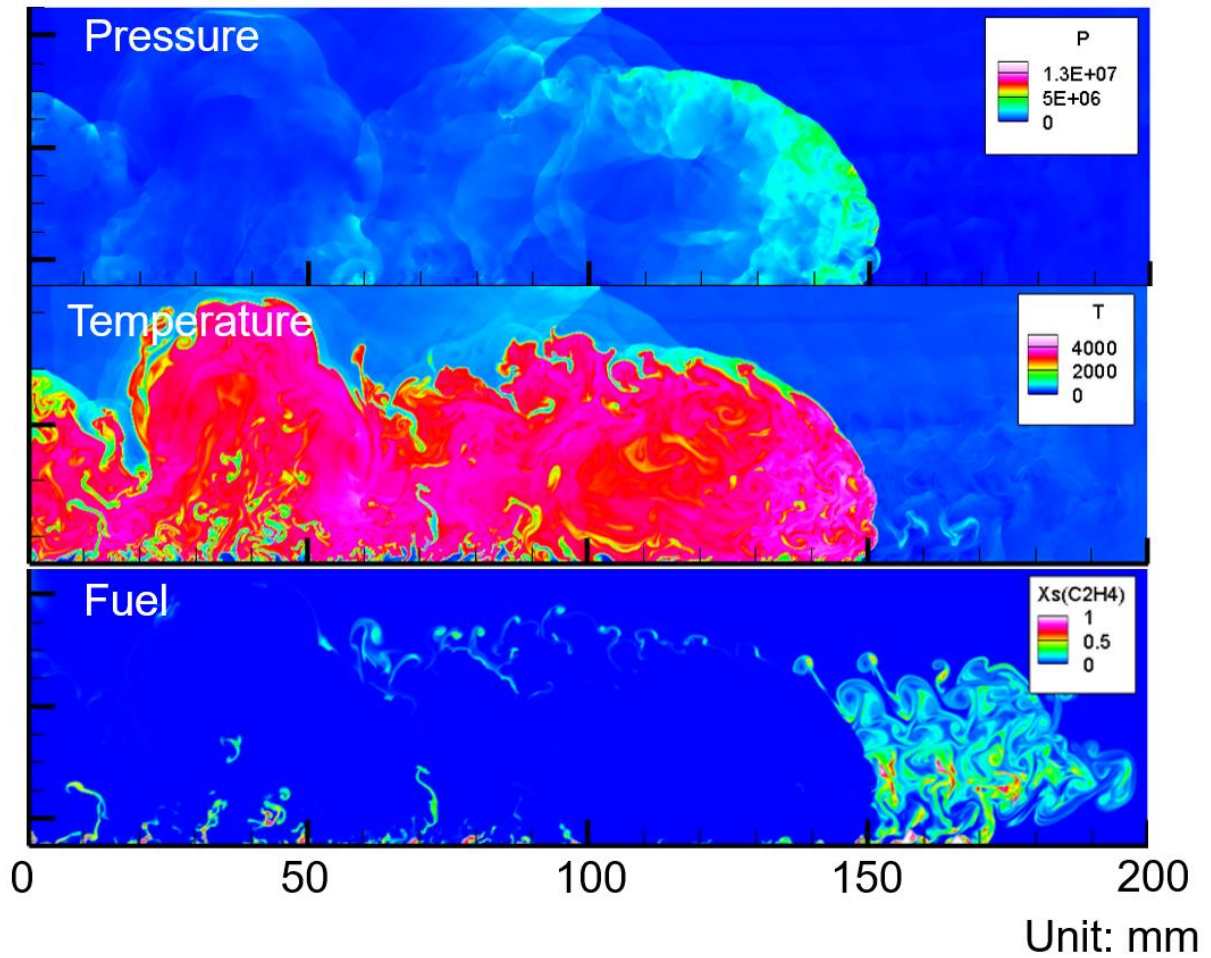


Fig. 2: Two-dimensional numerical analysis of detonation waves propagating in combustible jet trains.(Ethylene Oxygen non-premixed)

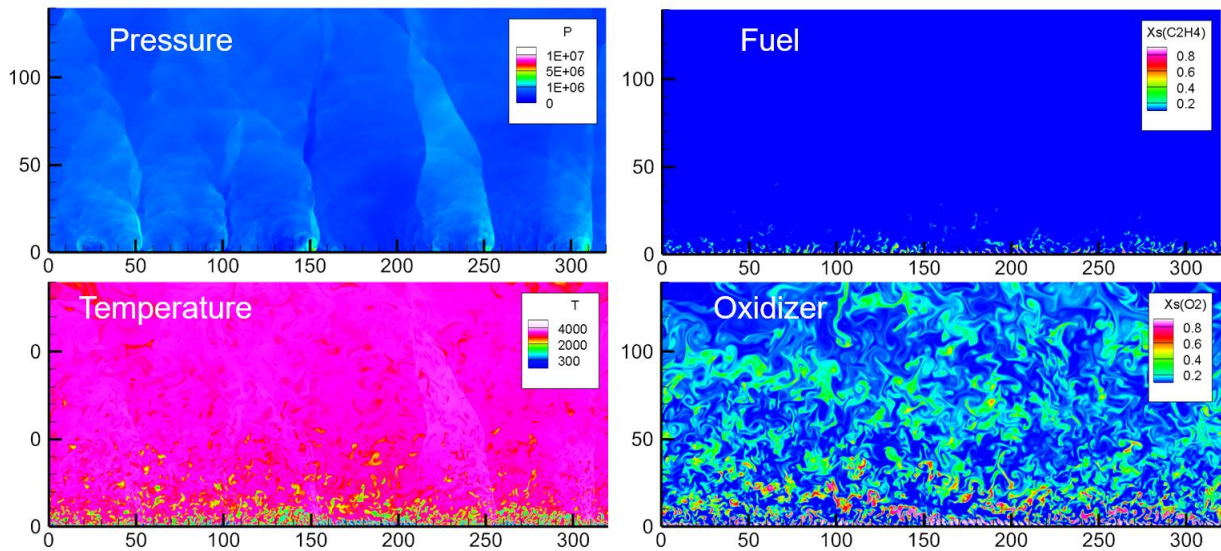


Fig. 3: Two-dimensional numerical analysis of a rotating detonation engine using ethylene oxygen.

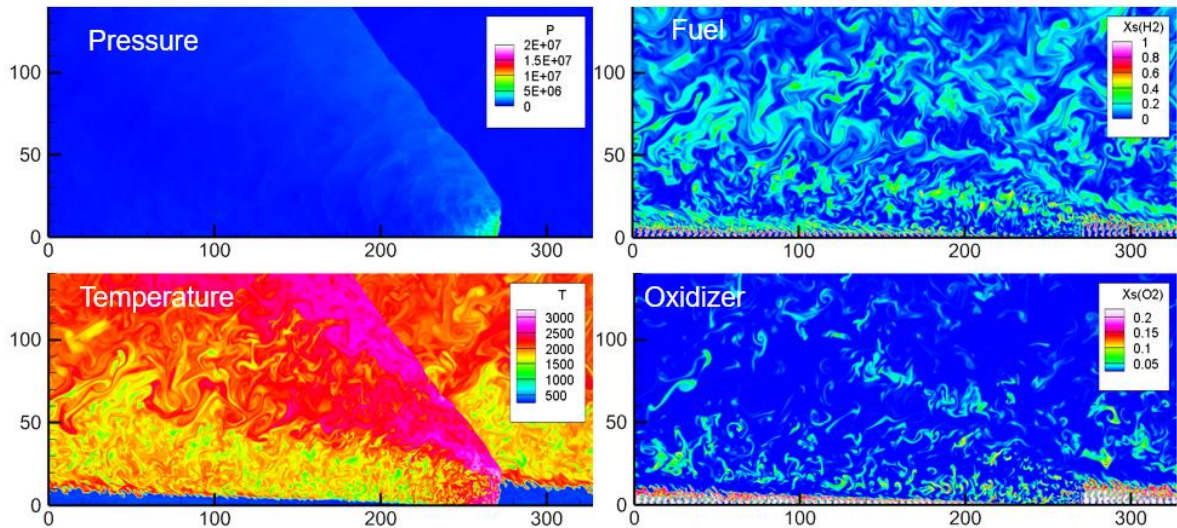


Fig. 4: Two-dimensional numerical analysis of a rotating detonation engine using hydrogen air.

● **Publications**

- Other

Doctor thesis: Experimental and numerical study on propagation of detonation wave in combustible jet train, Faming Wang, Tokai University (2023)

● **Usage of JSS**

● **Computational Information**

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

● **JSS3 Resources Used**

Fraction of Usage in Total Resources*1(%): 0.19

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage*2(%)
TOKI-SORA	5,110,736.53	0.22
TOKI-ST	0.83	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	260.00	0.24
/data and /data2	5,220.00	0.04
/ssd	150.00	0.02

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.