Numerical study on detonation propagation

● **Responsible Representative**

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● **Abstract**

For fundamental research on the advanced propulsion system using detonation waves, numerical method on detonation prpagation would be established in theis project.

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

The propagation speed of detonation waves are more than 2000 m/s. Therefore, the number of the model for culculation for our research easly reaches several houndreds million, even for a 2-D model. For such kind of numerical analysis, parallel computer with high performance is needed.

● **Achievements of the Year**

In this year, to establish the fundamental numerical procedure for detonation waves anallysis with numerical code CHARIOT, numerical analysis with Etheren/Oxgen premixed gas has been conducted. The results obtained are shown bellow;

- Propagation of detonation waves. (fig. 1)

- The cell structure of the detonation waves. (fig .2)

- Dependance of the detonation propagation analysis with CHARIOT on mesh size. (fig. 3)

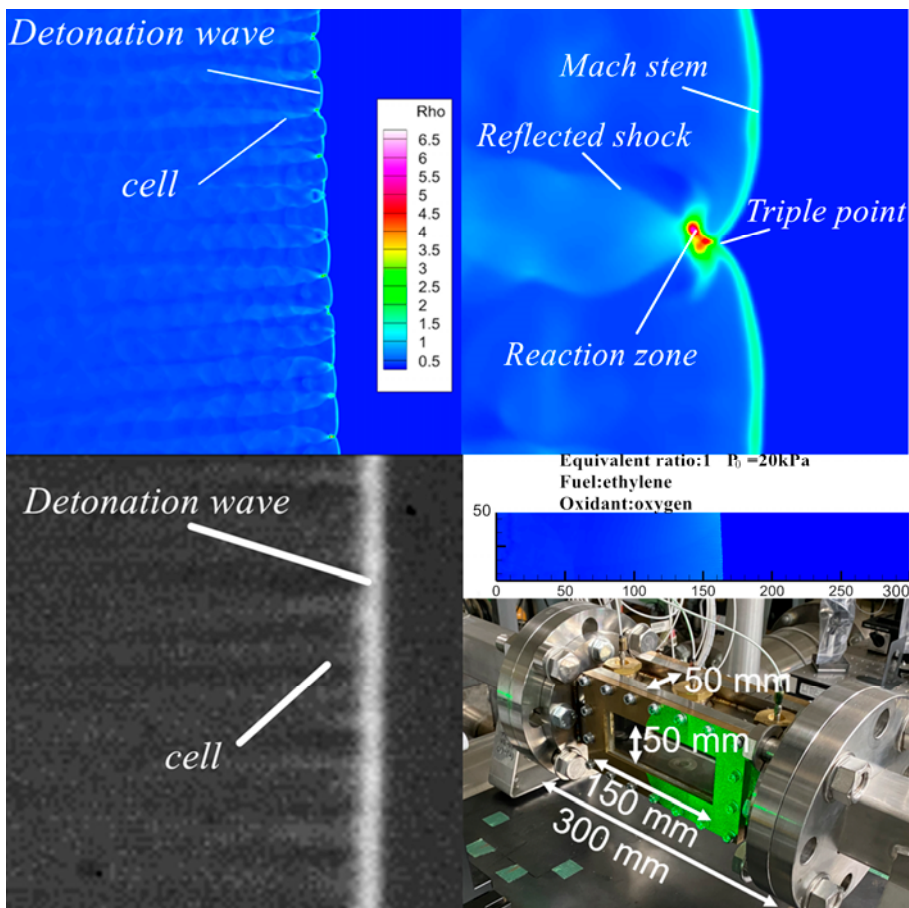- Dependance of the cell analysis with CHARIOT on mesh size. (fig. 3)
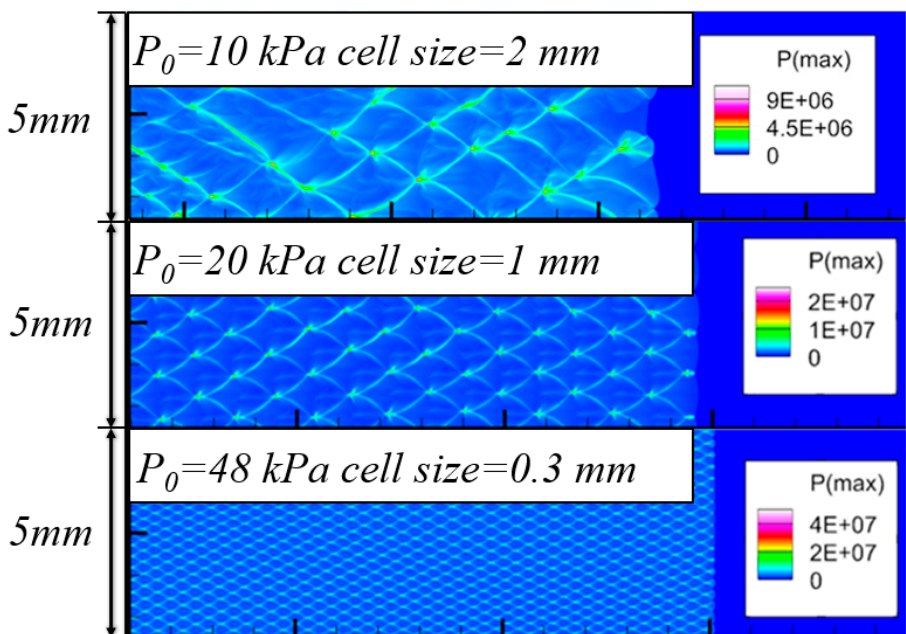
Fig. 1: Propagation of detonation waves.

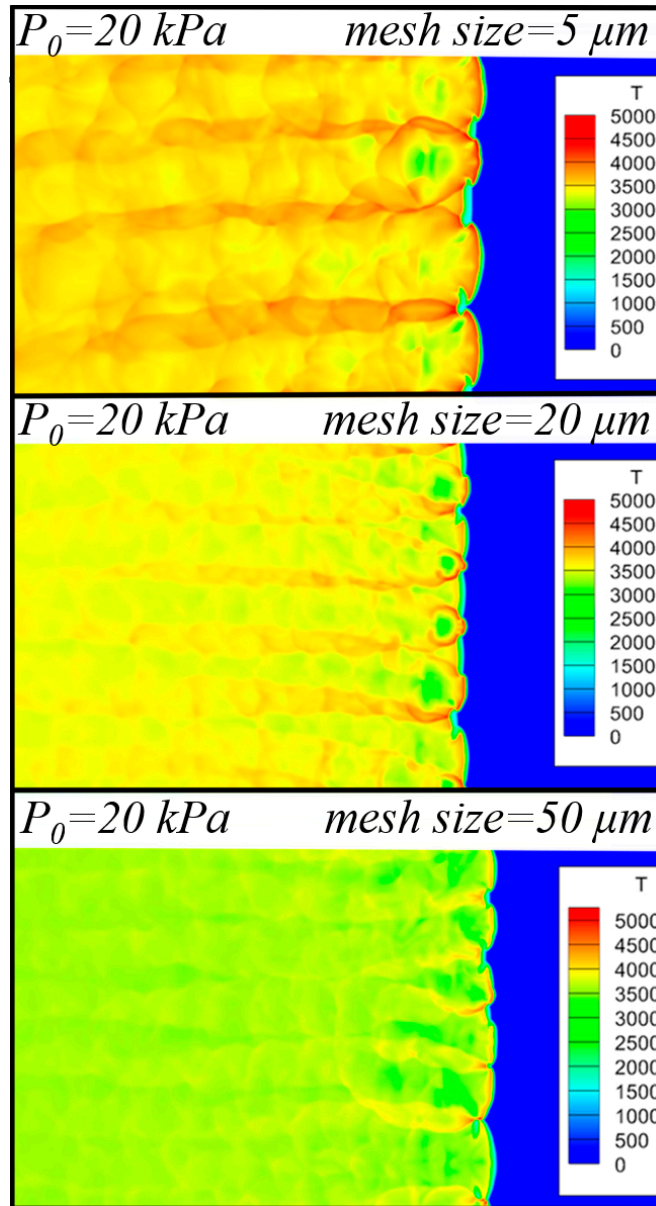Fig. 2: The cell structure of the detonation waves.

Fig. 3: Dependance of the detonation propagation analysis with CHARIOT on mesh size.
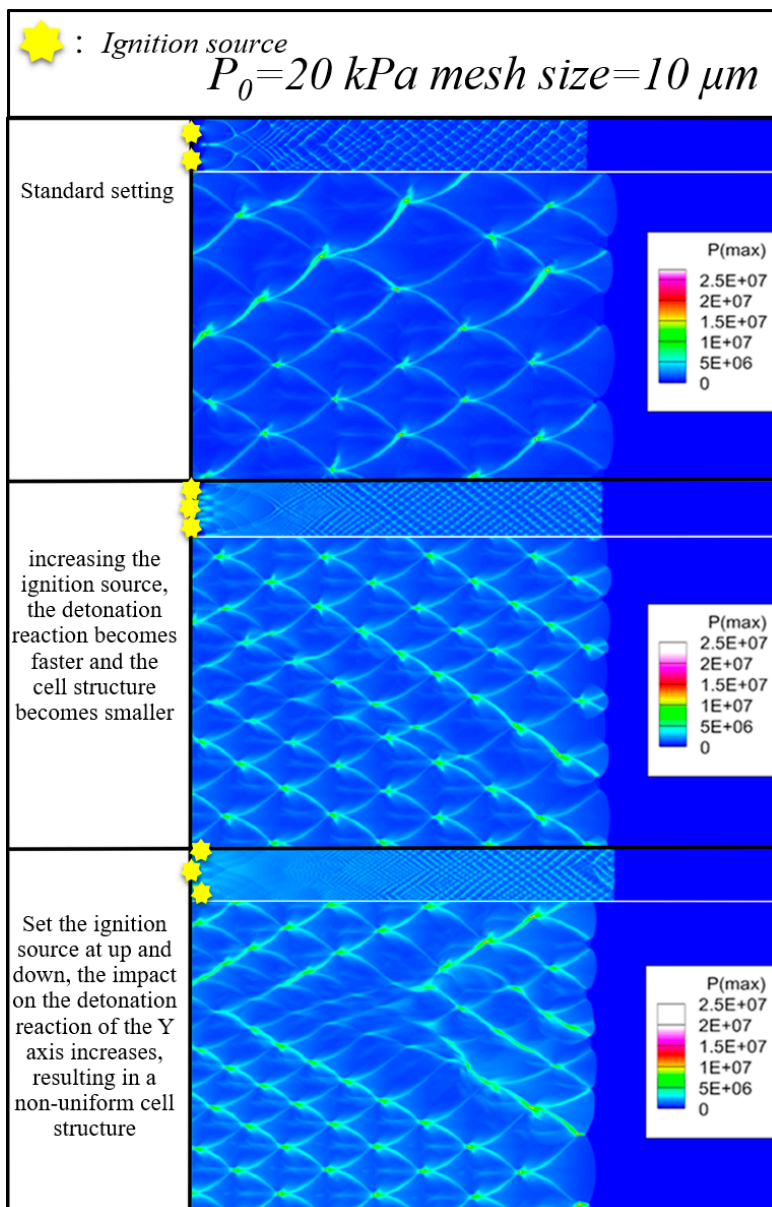
Fig. 4: Dependance of the cell analysis with CHARIOT on mesh size

● **Publications**

N/A

● **Usage of JSS**

● **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	4 - 12
Elapsed Time per Case	120 Hour(s)

- **Resources Used(JSS2)**

  Fraction of Usage in Total Resources[*1](%): 0.22

  Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
SORA-MA	1,307,276.13	0.25
SORA-PP	2.71	0.00
SORA-LM	0.00	0.00
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	247.96	0.23
/data	4,978.18	0.10
/ltmp	2,929.69	0.25

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.

● **Resources Used(JSS3)**

Fraction of Usage in Total Resources[*1](%): 0.01

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	0.00	0.00
TOKI-RURI	13.37	0.00
TOKI-TRURI	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	247.96	0.17
/data	4,978.18	0.08
/ssd	143.05	0.07

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.