Numerical analysis on combustion instability considering spray response

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Abstract

Numerical analysis on combustion instability considering spray response is performed to clarify phenomena and improve prediction capability of CFD in combustion instabilities.

Reasons and benefits of using JAXA Supercomputer System

Phenomena on spray combustion require a high calculation load, and the use of super computer is necessary.

Achievements of the Year

Numerical simulations were performed to investigate combustion instabilities on a coaxially-staged lean-burn fuel injector.

Firstly, a base model on the response of the fuel flow rate to pressure oscillation was employed for the analysis.

Afterwards, various artificial response delays were enforced to the base model to investigate its effects on combustion oscillations.

It was found that the dominant frequencies and amplitudes of pressure oscillations varied depending on the delays.

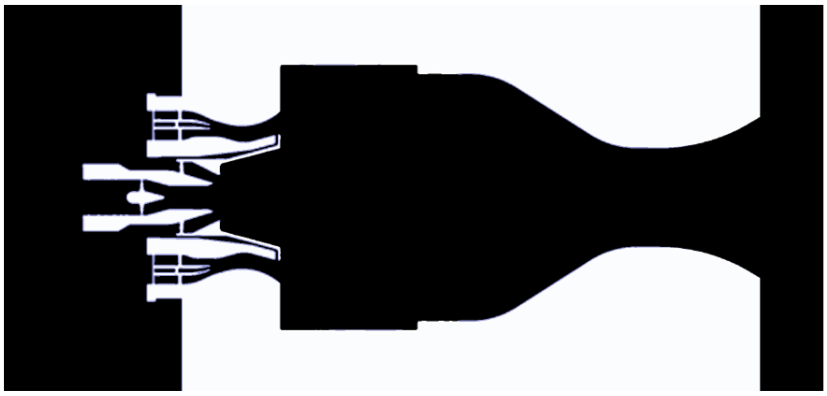
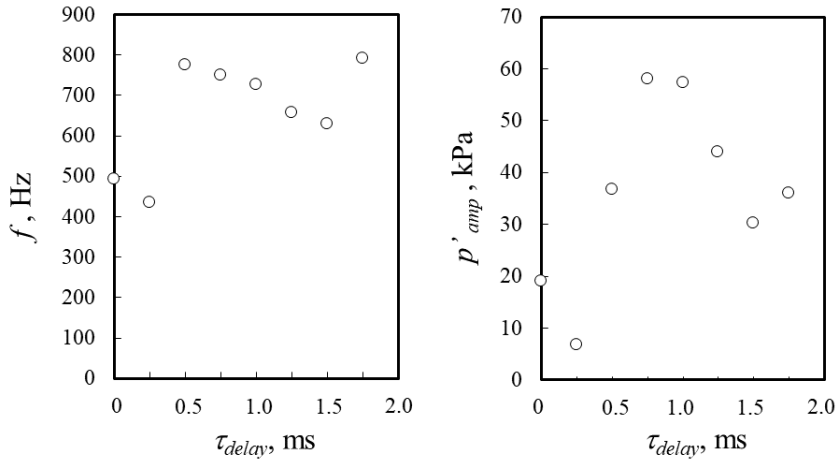


Fig. 1: Major part of numerical mesh for the combustor.



Courtesy of Prof. Kurose of Kyoto Univ. for technical advice on CFD method

Fig. 2: Effects of enforced time delays on the dominant frequencies and amplitudes of pressure oscillations in combustion instabilities.

Publications

N/A

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	512
Elapsed Time per Case	160 Hour(s)

JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 0.29

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	7,787,455.52	0.35
TOKI-ST	9,532.06	0.01
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	2.62	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	2.00	0.00
/data and /data2	115,158.33	0.71
/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)	92.19	0.04

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