Research on the performance improvement of practical aero-engine fuel injector

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● **Abstract**

Our study is focusing on the improvement of fuel injector performance. Numerical simulations on air-flow, atomization, fuel/air mixing, combustion, and thermal analysis on such injectors in realistic shapes are of our interest.

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

In order to analyze air-flow, atomization, fuel/air mixing, combustion, and thermal analysis of a realistic shape fuel nozzle precisely, we conduct the flamelet combustion analysis using large size of database, and the use of super computer is necessary.

● **Achievements of the Year**

Preliminary numerical simulations for an annular combustor were performed in order to investigate azimuthal combustion instabilities.

In one of the simulation cases, a "spinning-mode" type instability was captured.
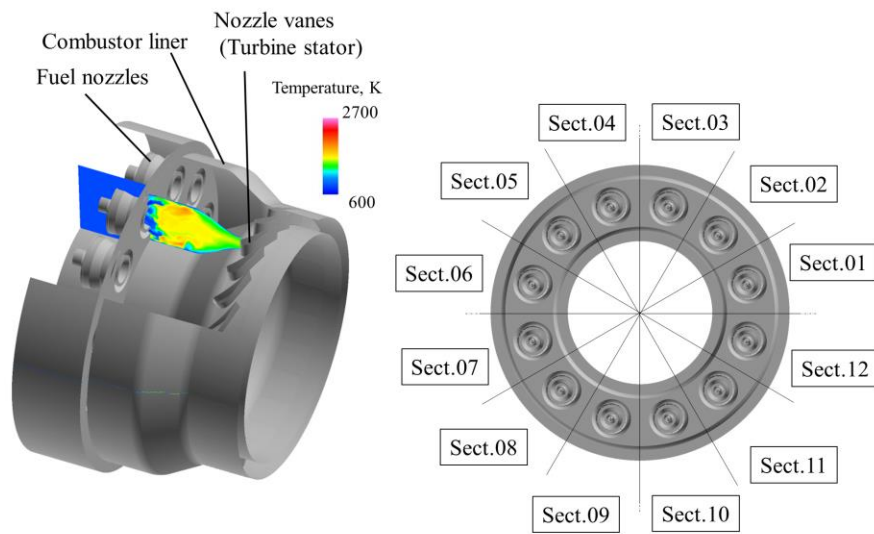
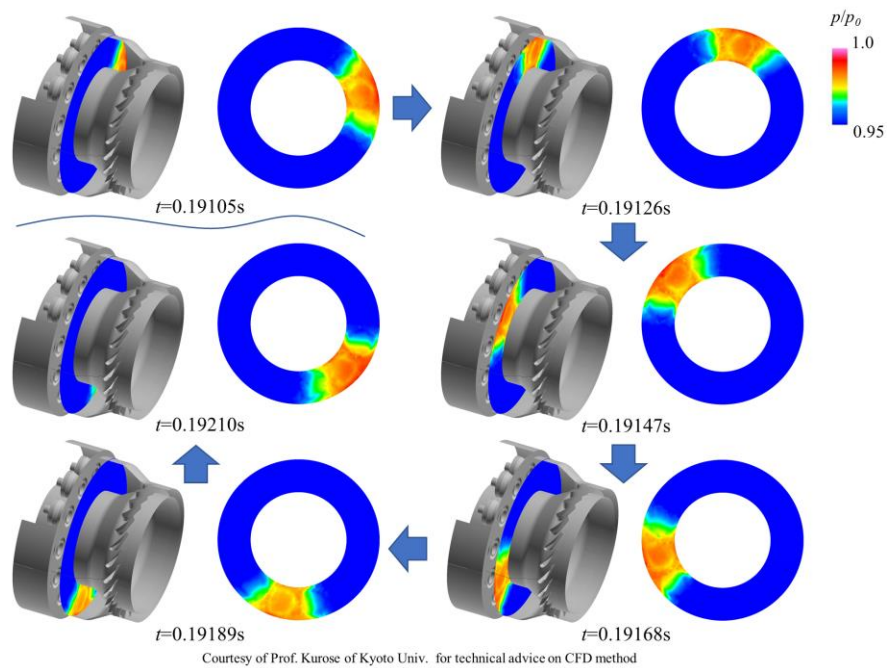Fig. 1: Major part of numerical mesh for the annular combustor.

Fig. 2: Time evolution of pressure distribution during an oscillation cycle.
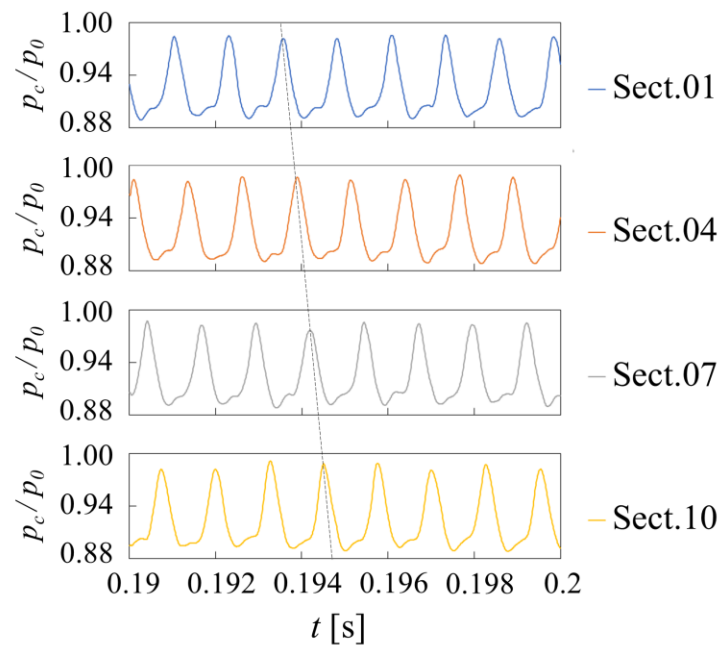
Fig. 3: Time evolution of pressure at monitoring positions in the combustion chamber.
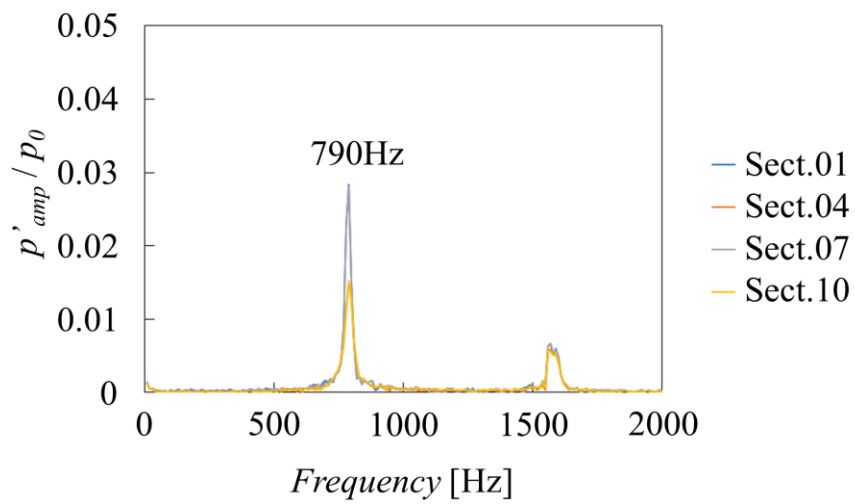

Fig. 4: Frequency spectra of pressure in the combustion chamber.

● **Publications**

N/A

🔵 Usage of JSS

● Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	2100
Elapsed Time per Case	76 Hour(s)

● JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 4.20

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	98,697,375.20	4.80
TOKI-ST	268,729.79	0.33
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	4,393.04	0.33
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	283.84	0.28
/data and /data2	185,057.77	1.98
/ssd	376.71	0.10

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2](%)
J-SPACE	0.09	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)	4,215.96	2.95

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