

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

Numerical simulations for an annular combustor were performed in order to investigate its combustion instabilities.

Two cases were studied: Case I with all of twelve fuel injectors in the same design (Design A) , and Case II with six of fuel injectors in Design A and the rest in Design B.

The difference between the two cases in terms of characteristics of combustion instability was successfully captured.

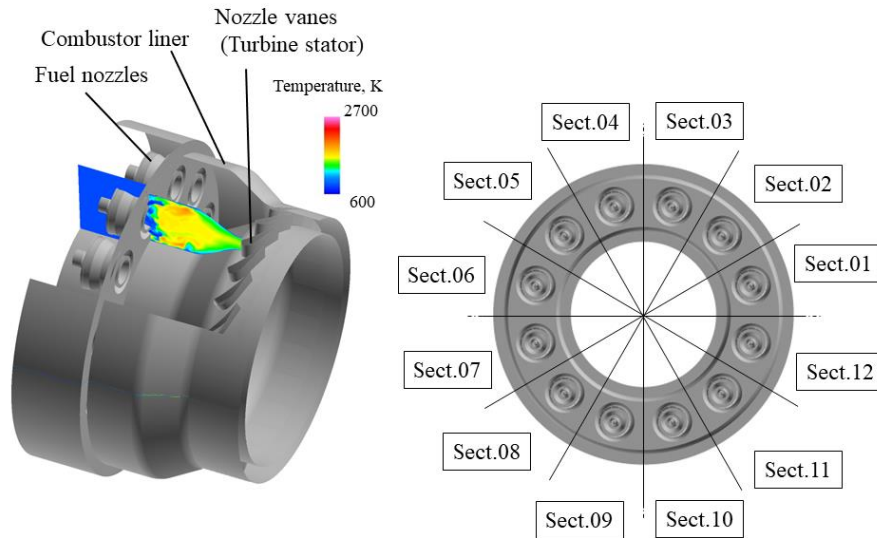


Fig. 1: Major part of numerical mesh for the annular combustor.

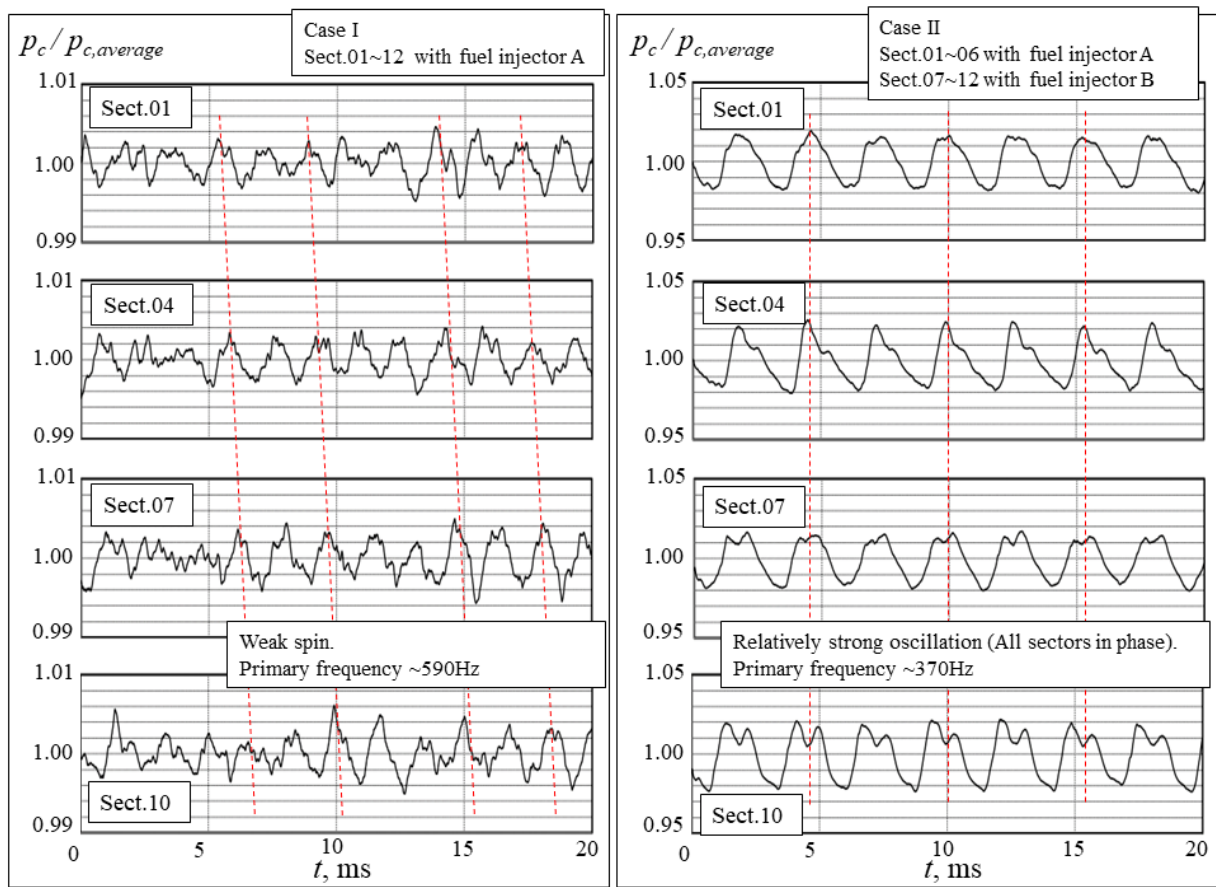


Fig. 2: Time evolution of pressure at monitoring positions in the combustion chamber.

- **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	120 Hour(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources*1(%): 2.89

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage *2(%)
TOKI-SORA	77,773,063.81	3.39
TOKI-ST	192,921.96	0.19
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	23,480.13	1.57
TOKI-TST	2,366.29	0.06
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	266.15	0.24
/data and /data2	187,357.33	1.44
/ssd	299.17	0.04

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)	3,419.09	2.38

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