

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

A numerical simulation on an aero-engine lean-staged fuel injector was performed for a condition at which combustion oscillation was observed in our experiment. It was also observed in the CFD result as shown in the figures below.

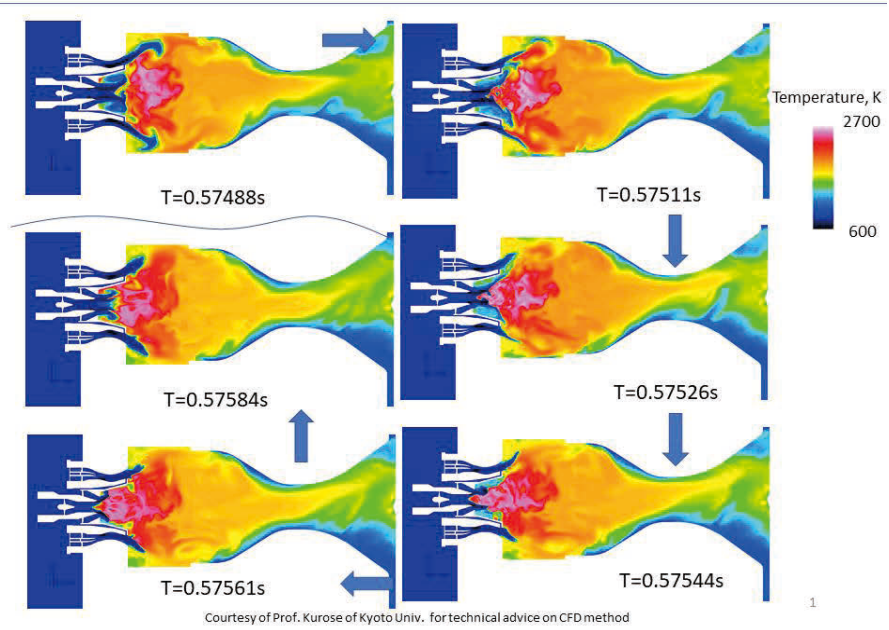


Fig. 1: Time evolution of temperature distribution during an oscillation cycle.

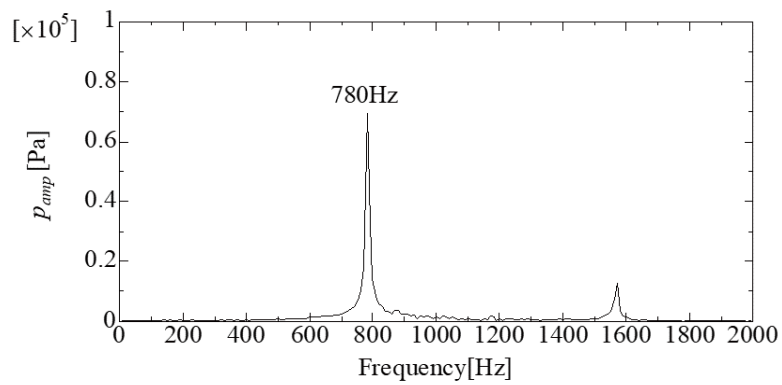


Fig. 2: Frequency spectrum of pressure in the combustion chamber.

● Publications

N/A

● Usage of JSS2

● Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	512
Elapsed Time per Case	104 Hour(s)

● Resources Used

Fraction of Usage in Total Resources*1(%): 0.96

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2(%)
SORA-MA	8,597,280.89	1.04
SORA-PP	0.00	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	381.56	0.32
/data	44,675.39	0.76
/ltmp	13,495.17	1.15

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	0.11	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.