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

Report Number: R20EBA30200
Subject Category: Aeronautical Technology
URL: https://www.jss.jaxa.jp/en/ar/e2020/14247/

Responsible Representative

Takashi Yamane, Aeronautical Technology Directorate, En-Core Pre-project team

Contact Information

Kazuaki Matsuura, Japan Aerospace Exploration Agency, Aeronautical Technology Directorate, En-Core Project team(matsuura.kazuaki@jaxa.jp)

Members

Kazuaki Matsuura, Mitsumasa Makida, Naoki Nakamura, Jun Iino, Huilai Zhang, Kinya Saito, Kunihiko Sakata, Harumi Toriyama, Takahiro Inagawa, Aya Yoshida

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 preliminary numerical simulation for combustion oscillation in the combustor with a choked outlet was performed. Pressure oscillation at a single dominant frequency was observed. The r.m.s. values of the pressure oscillation on the central axis were nearly constant in a wide range of axial locations.

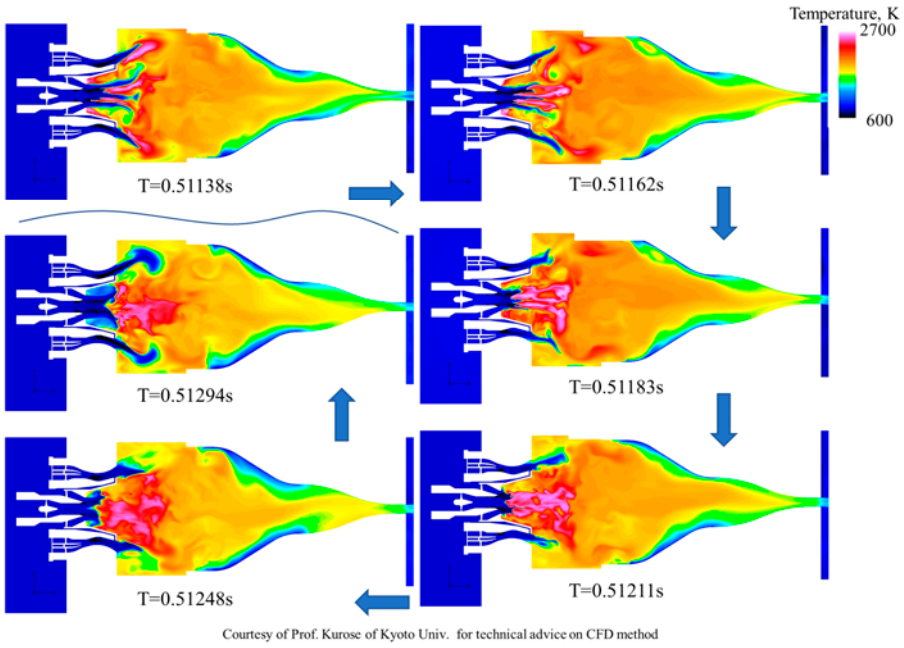

Fig. 1: Time evolution of temperature distribution during an oscillation cycle.

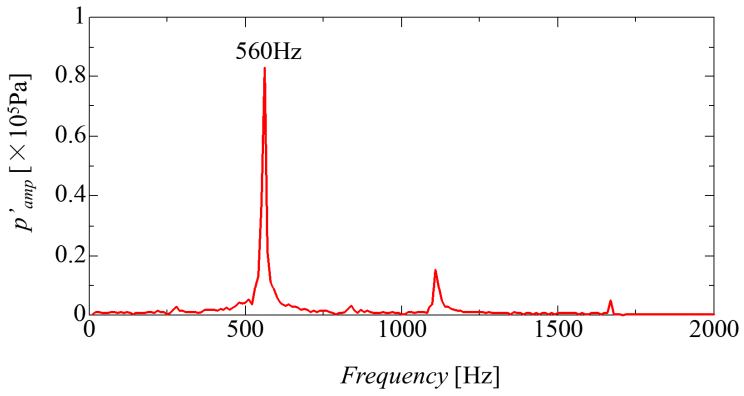

Fig. 2: Frequency spectrum of pressure in the combustion chamber.

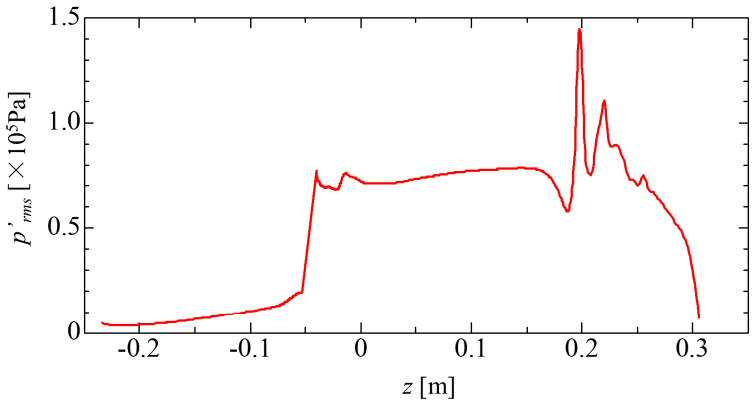

Fig. 3: Distributions of r.m.s. values of pressure oscillations on the central axis.

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	119 Hour(s)

- **Resources Used(JSS2)**

Fraction of Usage in Total Resources[*1](%): 1.70

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
SORA-MA	10,025,652.16	1.90
SORA-PP	11,250.51	0.09
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	364.23	0.33
/data	72,003.95	1.39
/ltmp	11,814.93	1.01

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2](%)
J-SPACE	0.10	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](%): 1.56

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	8,060,150.54	1.73
TOKI-RURI	64,742.23	0.37
TOKI-TRURI	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	370.43	0.25
/data	72,235.32	1.21
/ssd	547.68	0.29

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2](%)
J-SPACE	0.10	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.