Investigation of internal flow of aircraft combustor for Green Engine Project.

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Abstract

In the development process of aircraft combustors, air mass flow distribution between fuel nozzles, dilution and cooling air holes on the liner effects performances of combustors. So it is important to understand the internal flow and estimate the mass flow distribution. In this research, we conduct cold-flow simulations of internal flow inside the combustor which faithfully simulates the configuration of practical combustor. Then we aim to develop methods to analyze aerodynamic performance of combustors such as air mass flow distribution with high accuracy.

http://www.aero.jaxa.jp/eng/research/ecat/greenengine/

Reasons for using of JSS2

It is important to do parametric case study with slightly different geometry, and each case needs large scale simulation. To conduct such simulation effectively, we need the super computer with high parallelization efficiency.

Achievements of the Year

In this fiscal year, we conducted cold-flow simulations for a single-sector combustor. These simulations aimed to estimate the effect of the angle of conical heat shield on the internal flow of the combustor. Fig.1 shows the calculation girds and boundary conditions and Fig.2 shows stream lines from the pilot fuel nozzle for the heat shield angle of 45 degree. The calculation region starts from the inlet of the pressure-resistant casing to the outlet of the combustor. Calculations were also conducted for the angle of 50, 55 and 60 degree cases. To do parametric studies by changing minimum parts of combustor

configuration, the overset boundary method, in which corresponding parts can be changed, is effective.

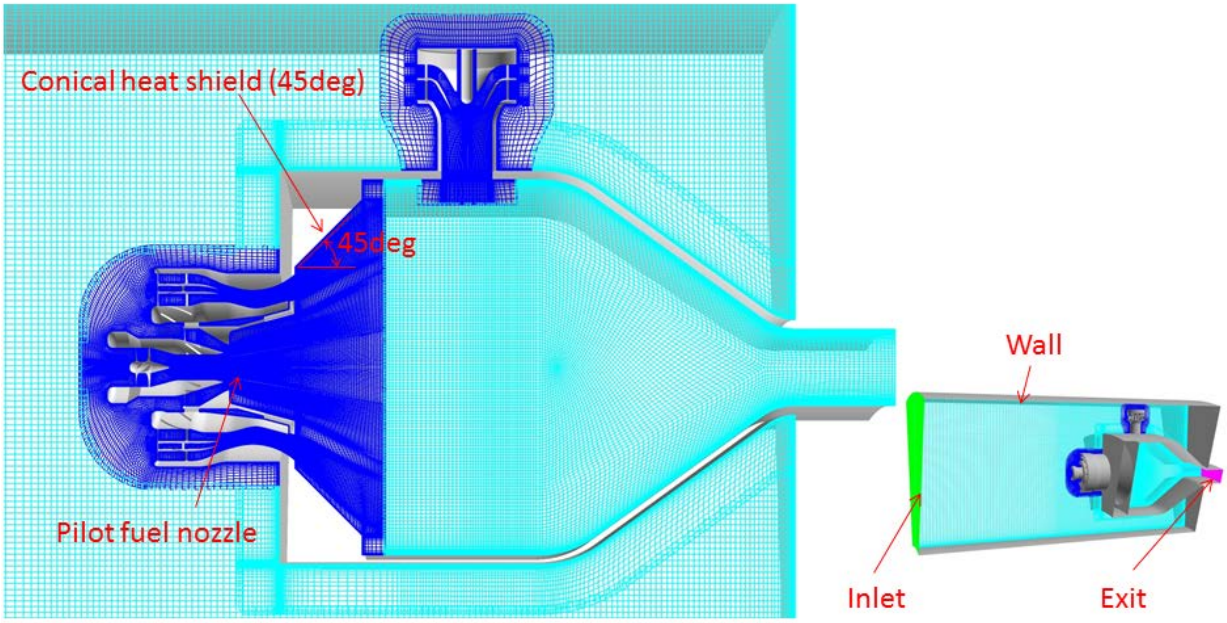

Fig.1 Calculation grids and boundary conditions for single-sector combustor

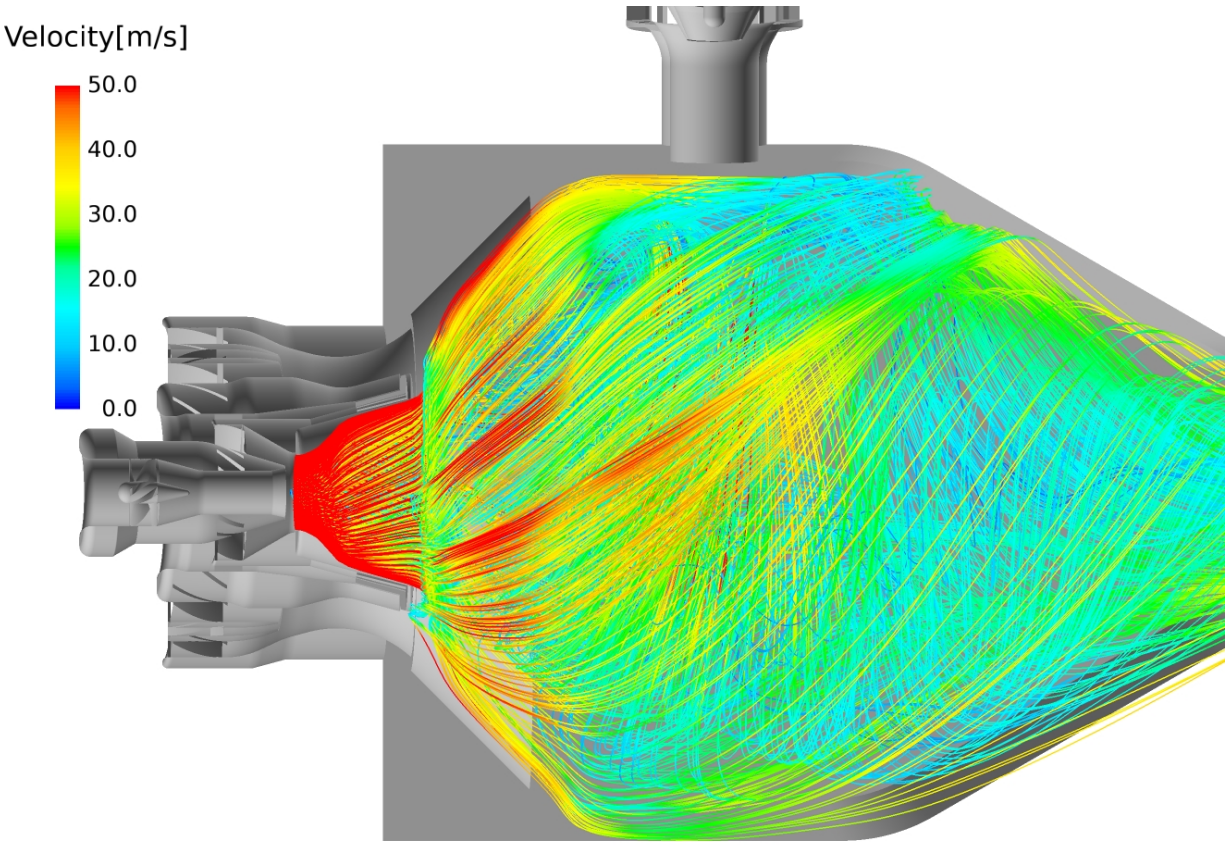

Fig.2 Stream lines from pilot fuel nozzle

Publications

- Presentations

1) Seiji YOSHIDA, Takeshi YAMAMOTO, Mitsumasa MAKIDA, Kazuo SHIMODAIRA(JAXA) and Naoki NAKAMURA(ASIRI), "Effects of Flare Angle of Conical Heat Shield on Combustion Characteristics of Lean Axially Staged Combustor", 45th Annual Conference of GTSJ, 2017.10.

Usage of JSS2

- Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	Automatic Parallelizatio
Number of Processes	64
Elapsed Time per Case	250.00 hours

- Resources Used

Fraction of Usage in Total Resources*1 (%): 0.13

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	1,024,849.05	0.14
SORA-PP	1,944.38	0.02
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	093.25	0.06
/data	2,189.21	0.04
/ltmp	1,193.58	0.09

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	0.14	0.01

*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