Acoustic Liner Program for High-bypass-ratio Aricraft engines

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Abstract

The trend in turbofan engines is towards higher bypass ratio and shorter nacelles. The eigne noise will increase due to smaller sound absorption area resulting from shorter nacelles. We aim to develop next-generation acoustic liner technologies that achieve both noise reduction and fuel efficiency and mainly focus on aerodynamic drag reduction on the liner surface.

Reasons and benefits of using JAXA Supercomputer System

To perform computationally expensive turbulent analysis.

Achievements of the Year

Our numerical analysis concerns flow fields around resonant acoustic liners consisting of a hole, a honeycomb core, and a rigid backplate. In order to investigate the effect of liner hole geometries, Large Eddy Simulation (LES) was performed with the three different hole geometries as shown in Fig.1, and Mach number of the main flow inside the duct was set to 0.3. The instantaneous velocity field is shown in Fig.2, and the time-averaged velocity fields for each hole geometry are shown in Fig.3. It is clear that the parforation in the main flow direction affects the flow field inside the hole and the aerodynamic drag on the liner surface.

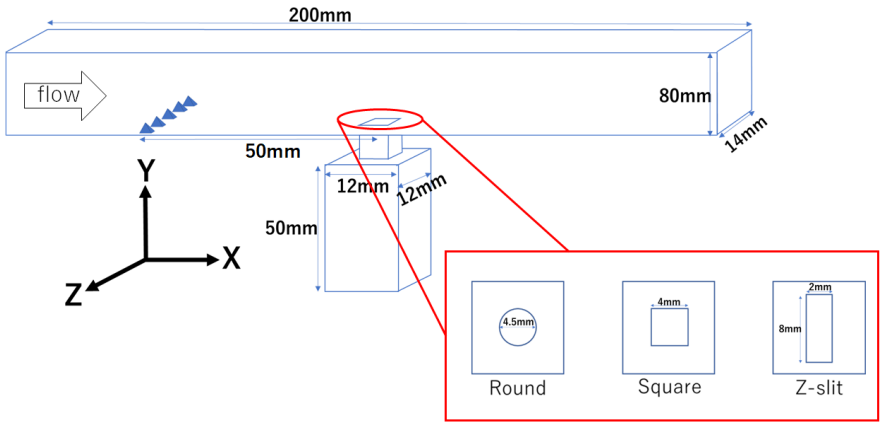

Fig. 1: Computational domain

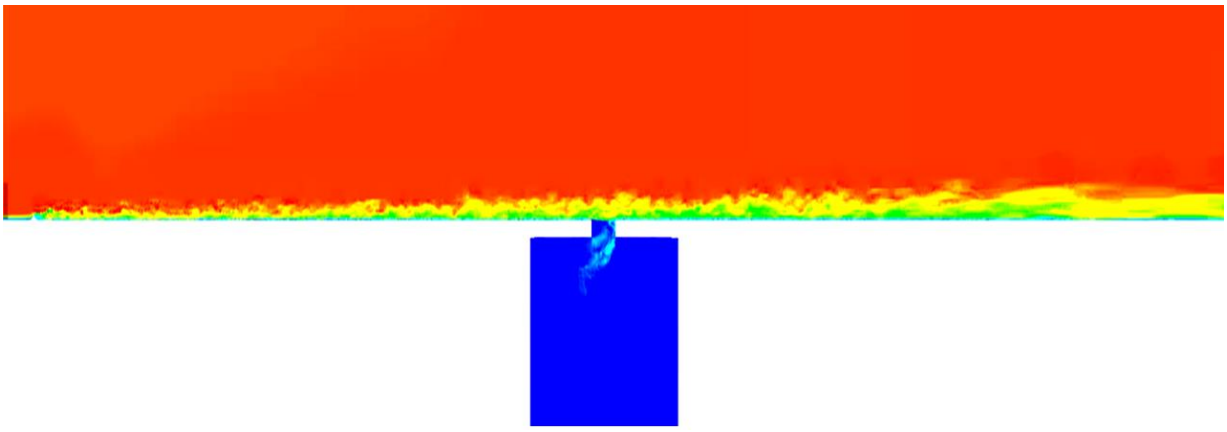

Fig. 2: Instantaneous velocity field for "round hole" case

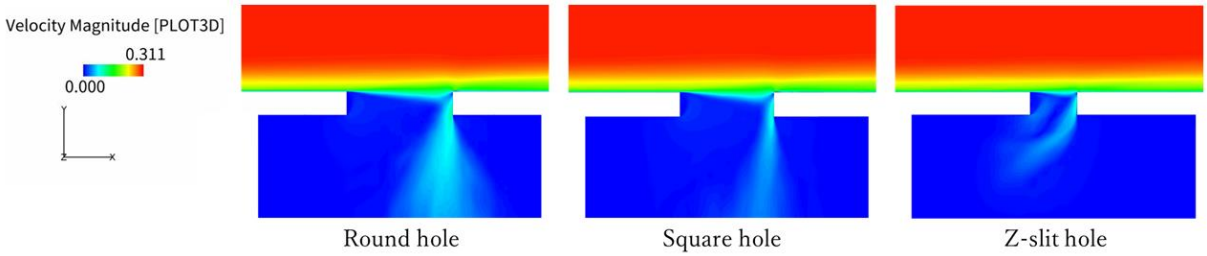

Fig. 3: Time-averaged velocity fields

- **Publications**

  N/A

- **Usage of JSS**

- **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	48
Elapsed Time per Case	90 Hour(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.09

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	2,237,572.37	0.10
TOKI-ST	14,688.22	0.01
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	0.00	0.00
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	524.36	0.47
/data and /data2	138,996.41	1.07
/ssd	10,700.51	1.48

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2] (%)
J-SPACE	20.86	0.09

[*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)	385.31	0.27

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