# Acoustic Liner Program for High-bypass-ratio Aircraft engines (acoustic performance improvement)

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## Abstract

Ultra high bypass ratio aviation jet engines have a smaller sound absorbing liner area than conventional engines. In this project, we will develop sound-absorbing device technology that provides high noise reduction performance even with a small-sized sound-absorbing liner.

## Reasons and benefits of using JAXA Supercomputer System

To perform many LES calculations by changing the shape of the sound absorbing liner and the incident sound frequency, the calculation performance and the storage capacity of JAXA supercomputer system were required.

## Achievements of the Year

In this study, we are conducting numerical simulations of the phenomena that occur when sound is incident on an acoustic liner used to reduce the noise of jet engines for aircraft. This year, we evaluated the acoustic impedance of the acoustic liner using a method that measures the transfer matrix of the acoustic liner by numerical simulation. Figure 1 shows the increase in particle velocity inside the holes of the acoustic liner when the incident sound is 110 dB. Figure 2 shows the case of an incident sound pressure of 150 dB, and it can be seen that the particle velocity that has passed through the holes in the acoustic liner is emitted as a fluid with velocity without returning to the sound pressure. Figure 3 shows the acoustic impedance obtained using this method. It was found that the trends obtained in the experiment could be reproduced, such as the fact that the resistance increases as the incident sound pressure increases, and that the reactance shifts to the low-frequency side.

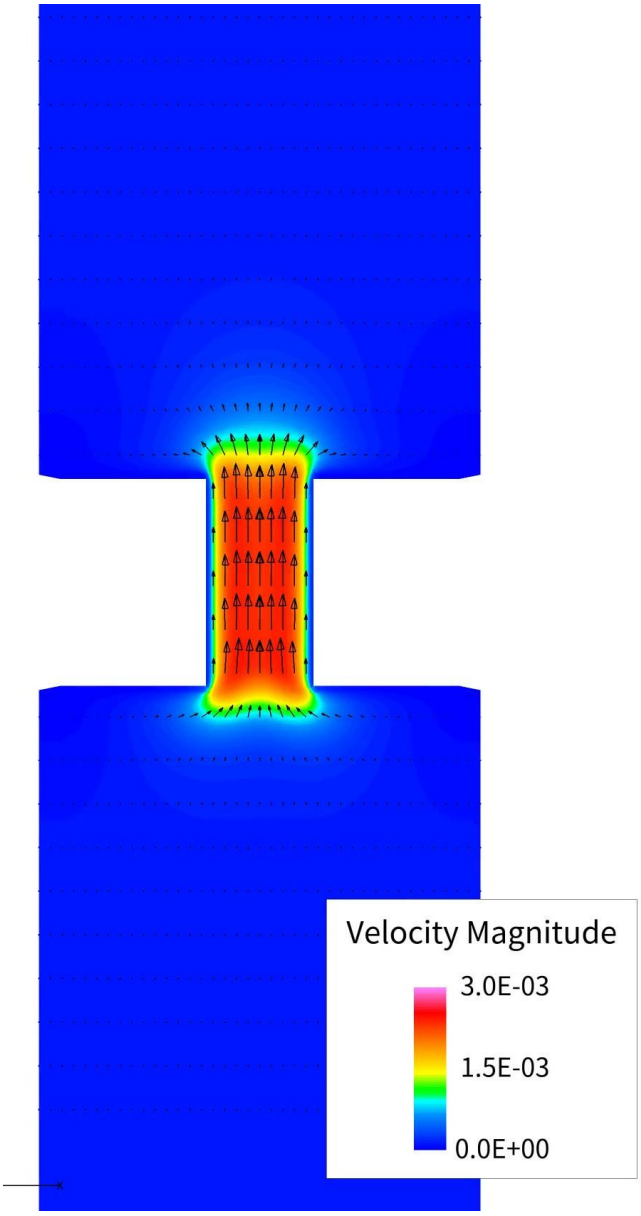


Fig. 1: Particle velocity around the holes in the acoustic liner (incident sound pressure 110dB)

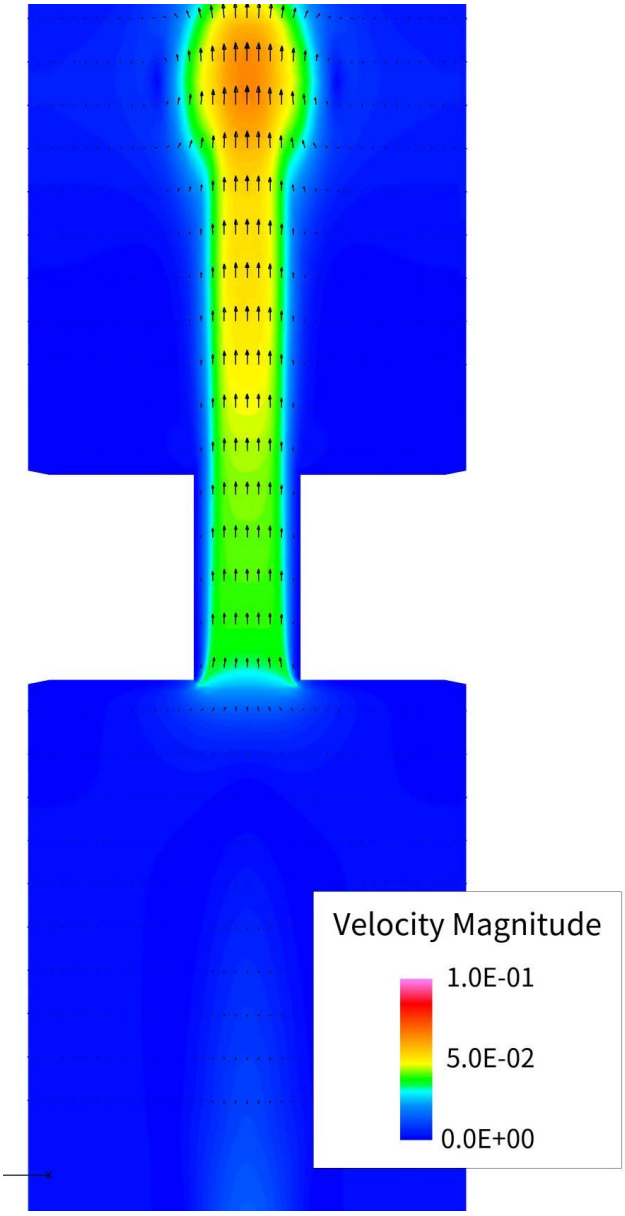


Fig. 2: Particle velocity around the holes in the acoustic liner (incident sound pressure 150dB)

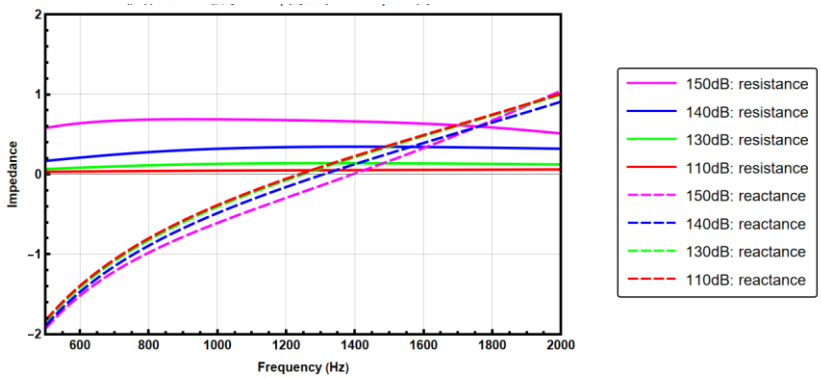


Fig. 3: Acoustic impedance obtained using the transfer matrix method with numerical simulation.

- **Publications**

  N/A

- **Usage of JSS**

- **Computational Information**

| | |
|---|---|
| Process Parallelization Methods | MPI |
| Thread Parallelization Methods | OpenMP |
| Number of Processes | 20 |
| Elapsed Time per Case | 3 Hour(s) |

- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.02

Details

| Computational Resources | | |
|---|---|---|
| System Name | CPU Resources Used (core x hours) | Fraction of Usage[*2](%) |
| TOKI-SORA | 229,409.80 | 0.01 |
| TOKI-ST | 47,876.17 | 0.05 |
| 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 | 496.43 | 0.33 |
| /data and /data2 | 12,427.14 | 0.06 |
| /ssd | 31,078.57 | 1.67 |

| Archiver Resources | | |
|---|---|---|
| Archiver Name | Storage Used (TiB) | Fraction of Usage*2 (%) |
| J-SPACE | 17.47 | 0.06 |

*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) | 162.34 | 0.11 |

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