aFJR light weight sound absorption liner technology development

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Abstract

In order to improve the environmental compatibility of jet engines, we are developing sound absorbing liner technology to reduce jet engine noise. By a simulation that sound waves are absorbed by the sound absorbing liner, we aim to understand the characteristics of the sound absorbing liner and devise a shape with a higher sound absorption coefficient.

Ref. URL: http://www.aero.jaxa.jp/eng/research/ecat/afjr/

Reasons for using JSS2

The calculation is LES with a large amount of computation and storage usage. It was necessary to use SORA-PP, TPP, and SORA-FS.

Achievements of the Year

We attempted to acquire the sound absorbing characteristics of the sound absorbing liner under the glazing flow assuming a two-dimensional laminar flow by using UPACS-LES which is an analytical code with less attenuation of sound waves using a 6th order compact scheme. In Fig. 1, a sound wave passes through the hole of the sound absorbing liner. Figs. 2 and 3 are flow velocities (particle velocities) in and around the hole of the sound absorbing liner. Fig. 2 shows the case without glazing flow, the particle velocities reciprocate in the hole by the sound, and the shear is strong at the corner part of the hole. Fig. 3 shows a case where a glazing flow is present. Steady vortex is generated by the glazing flow, and the sound deforms the vortex. The mechanism of sound absorption differs considerably as compared with the case without glazing flow.

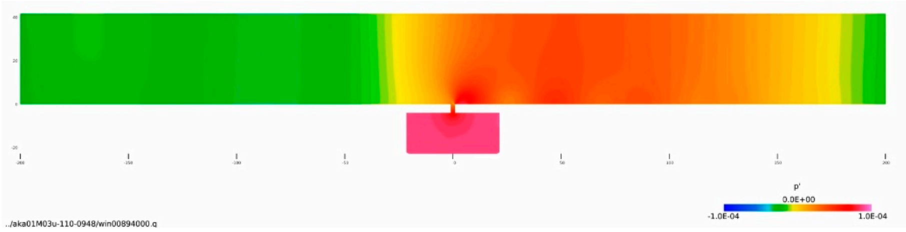

Fig. 1: Sound pressure of acoustic liner with glazing flow
(Video. Video is available on the web.)

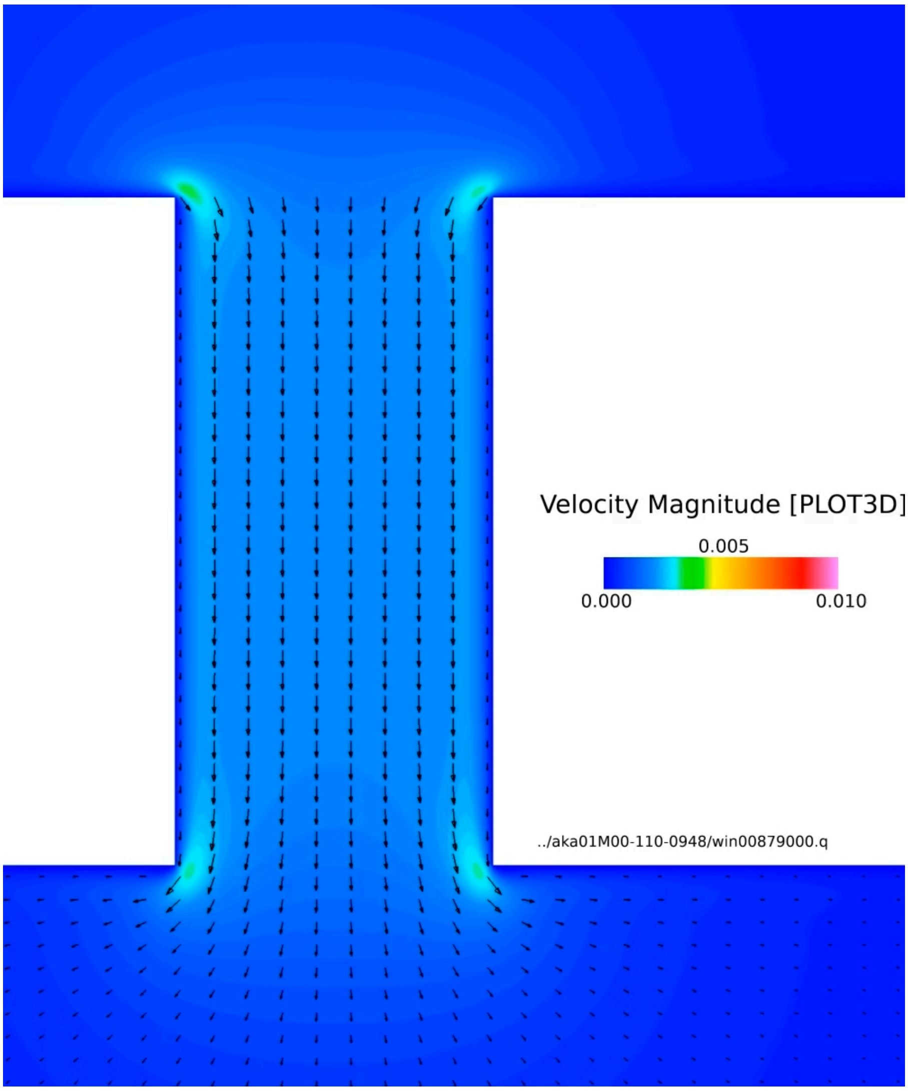

Fig. 2: Particle velocity inside the hole of the acoustic liner without glazing flow
(Video. Video is available on the web.)

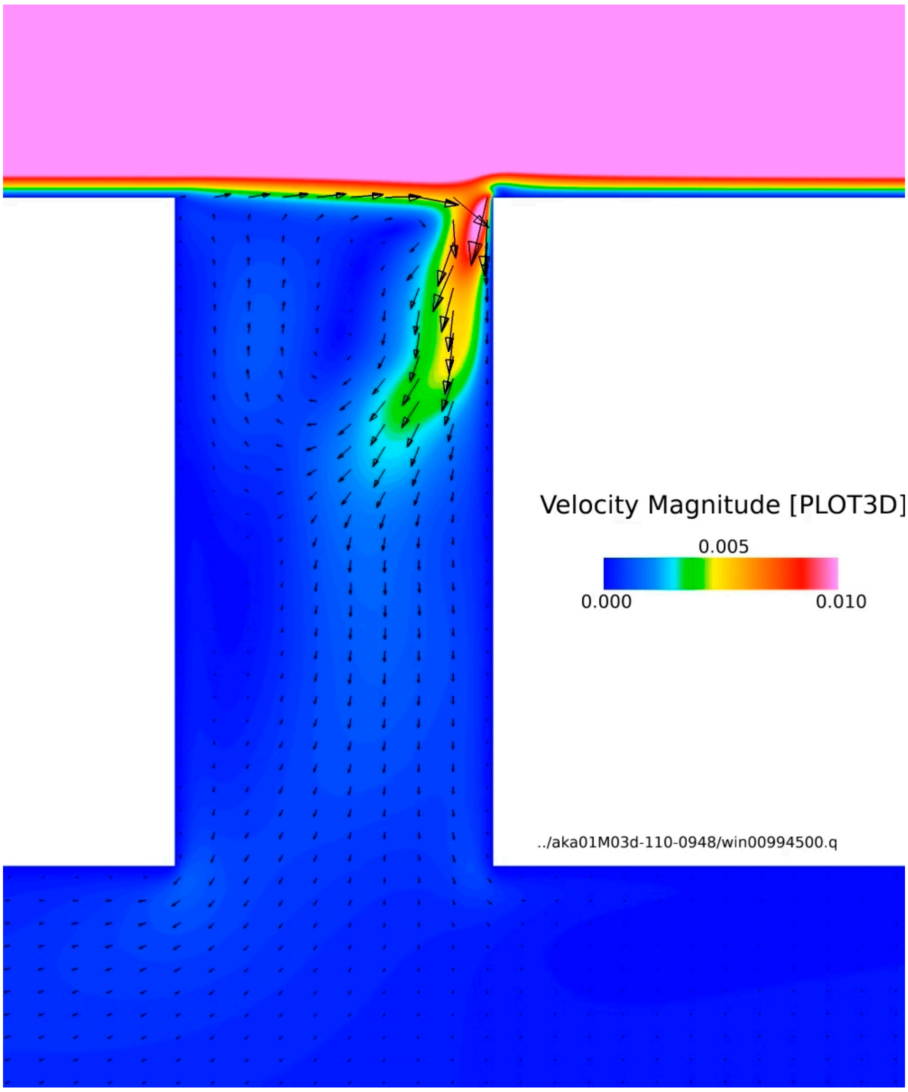

Fig. 3: Particle velocity inside the hole of the acoustic liner with glazing flow
(Video. Video is available on the web.)

Publications

- Non peer-reviewed papers

1) Shunji Enomoto, Tatsuya Ishii (JAXA), Yusuke Akamisaka, Hidemi Toh (Kanazawa Institute of Technology), "Numerical Analysis of Acoustic Liner Performance in an Impedance Tube Test", Proceedings of the 50th Fluid Dynamics Conference / the 36th Aerospace Numerical Simulation Symposium, JAXA-SP-18-005

2) Hitoshi Morita, Yusuke Akamisaka, Hidemi Toh (Kanazawa Institute of Technology), Shunji Enomoto, Tatsuya Ishii, Kenichiro Nagai (JAXA), "Effect on acoustic absorption properties of flow condition and acoustic liner aperture ratio in the grazing flow", The 59th conference on Aerospace Propulsion and Power, The Japan Society for Aeronautical and Space Sciences.

Usage of JSS2

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	24
Elapsed Time per Case	40 Hour (s)

Resources Used

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

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	0.00	0.00
SORA-PP	51,971.67	0.42
SORA-LM	0.00	0.00
SORA-TPP	60,741.52	4.44

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2 (%)
/home	11.05	0.01
/data	3,329.19	0.06
/ltmp	665.84	0.06

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	9.53	0.33

*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.