Fundamental Research on Noise Generation Mechanisms from Airframe

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Abstract

The noise reduction technology for high-lift devices and landing gear draws international attention to reduce noise in areas around airports. FQUROH (Flight Demonstration of Quiet Technology to Reduce Noise from High-Lift Configurations) aims at raising the technical maturity level of the noise reduction technology for high-lift devices and landing gear to a level applicable to future development of aircraft and related equipment. In this business code, as the fundamental research on noise generation mechanisms from airframe, unsteady flow simulations for aeroacoustics evaluation were conducted to understand the basic physical phenomena of the noise caused by the interference between the main landing gear storage and the side brace flow from the main landing gear of the aircraft.

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

Reasons and benefits of using JAXA Supercomputer System

Due to high computational cost of high-fidelity unsteady flow simulations on the grids with fine resolution for aeroacoustics evaluation, the use of JSS2 is required to obtain multiple cases of the simulation within a limited period.

Achievements of the Year

The purpose of this research is to understand fundamental physics of flow interaction around the side-brace and the gear bay which could be airframe noise sources from main landing gear in the low-frequency range. Two-dimensional unsteady flow CFD simulations were conducted for the simplified problem which consists of an open cavity and a cylinder. The simulations with several different relative positions of the cylinder to the cavity revealed change of fluctuation mode of cylinder wake and shear layer by the cylinder positions (Figs. 1 and 2).

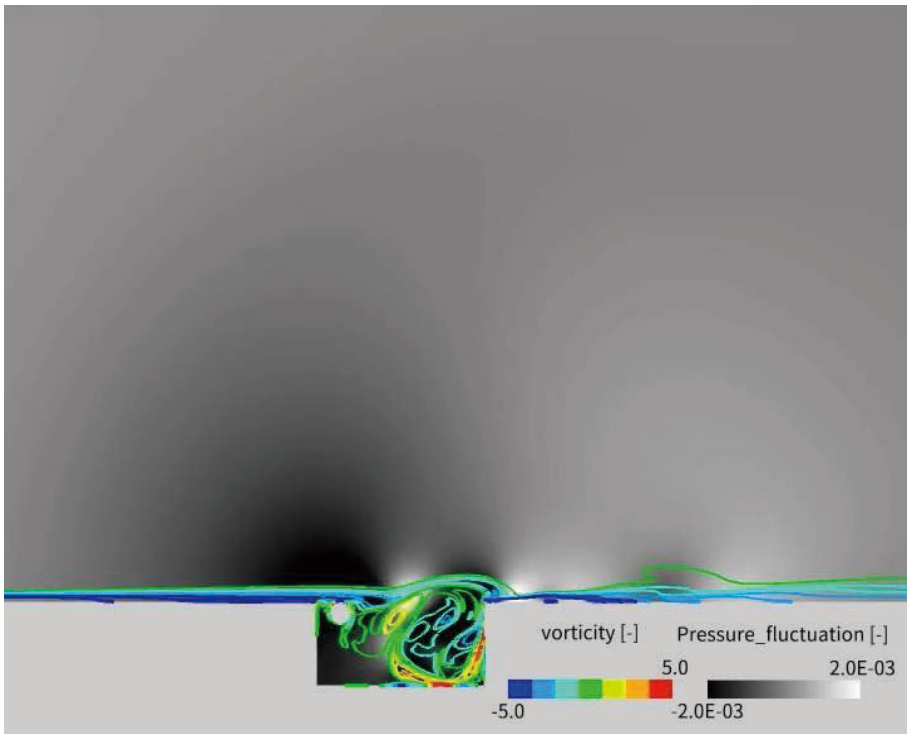

Fig. 1: Comparison of pressure fluctuations and vorticity contours with different relative positions of cylinder: (a) Cylinder inside cavity (Video. Video is available on the web.)

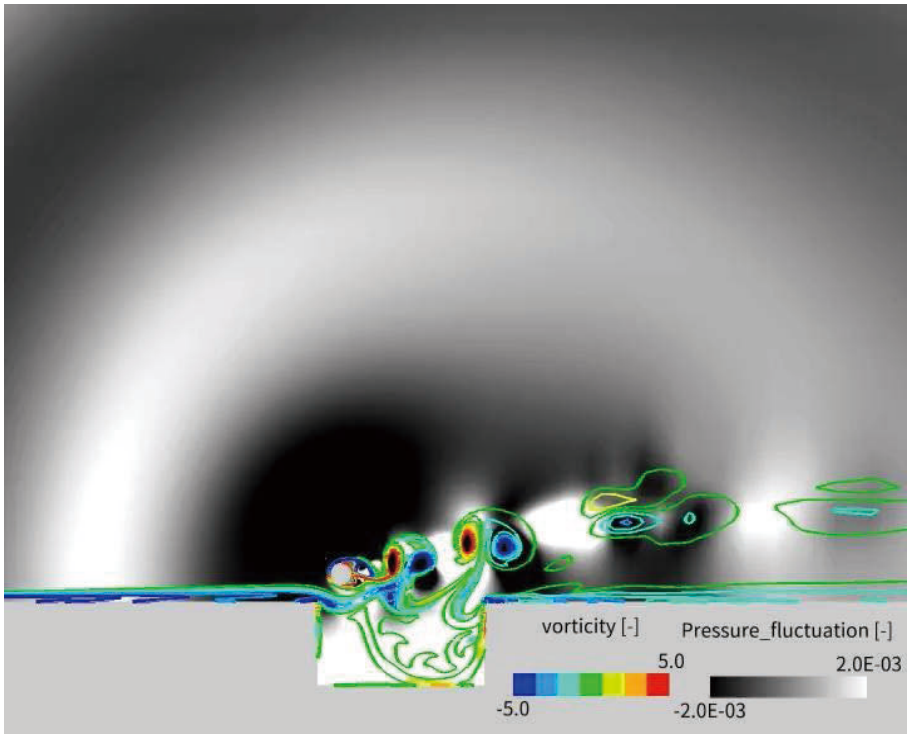

Fig. 2: Comparison of pressure fluctuations and vorticity contours with different relative positions of cylinder: (b) Cylinder outside cavity (Video. Video is available on the web.)

Publications

N/A

Usage of JSS2

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	80 - 120
Elapsed Time per Case	7200 Second(s)

Resources Used

Fraction of Usage in Total Resources[*1](%): 0.08

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
SORA-MA	310,386.20	0.04
SORA-PP	16,327.98	0.11
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	303.96	0.25
/data	35,825.54	0.61
/ltmp	3,871.48	0.33

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	280.18	7.05

[*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.