

Ffowcs Williams-Hawkings Acoustic Analogy Model

Problem/Description:

Please describe the Ffowcs Williams-Hawkings acoustic analogy model.

Solution:

Features of Ffowcs Williams-Hawkings acoustic analogy model (FWH method)

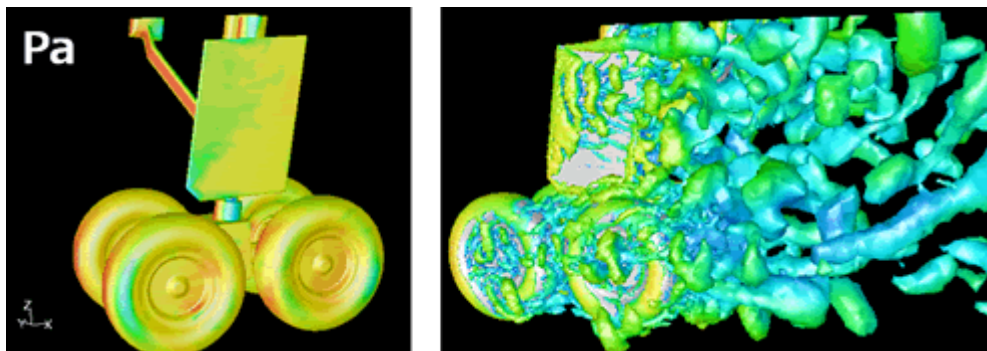
- Sound pressure variation in the frequency characteristic (Sound pressure Level: SPL) visualization
- Placing the receiver on the far field has a low computational cost compared to the solution (which can reduce the analysis area)
- When running the sound pressure attenuation from the sound source with respect to the distance of the receiver, the reflection of the sound waves is not taken into account

The FW-H model is a typical model of the acoustic analogy. To reduce the computational load, it must be analyzed separately from the generation and propagation of the sound. The acoustic analysis will solve the propagation of sound and then it will be analyzed separately from the fluid analysis to solve the occurrence.

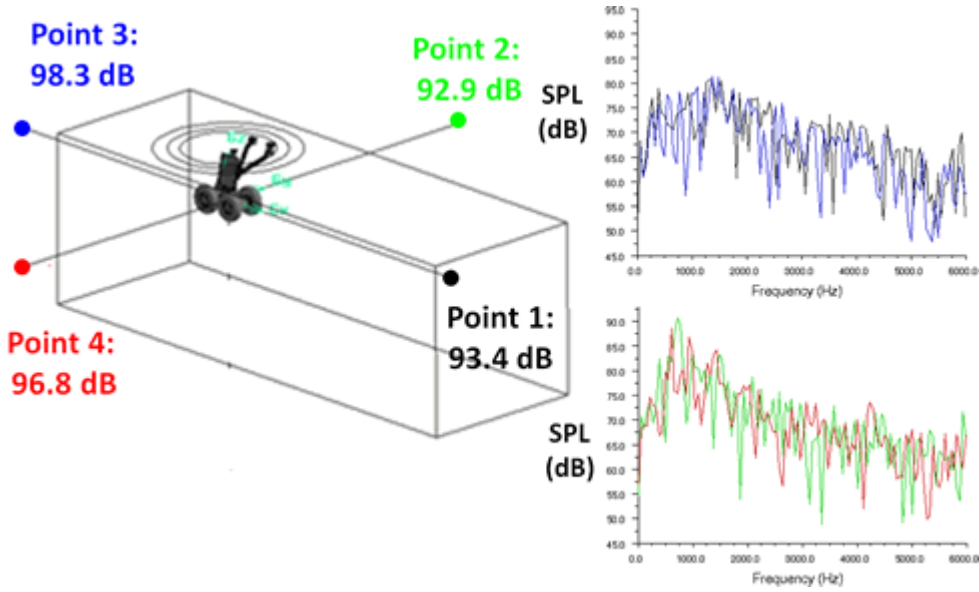
This approach can be simplified to the condition that there is a noise source that enables the calculation in the formulation of the integration analysis. The receiver to the sound source is located in the analysis area outside the far field. Calculate the sound pressure as a simple distance attenuation. Even as the wall exists between the sound source and the receiver, the reflection effect is not taken into account.

Analysis Example:

- Assume that the pressure fluctuations in the landing gear surface is as dominant as the FWH sound source.
- Verifying the symmetry of the sound pressure variations by placing the receiver on the front and rear left and right of the landing gear.



The surface pressure and the vortex structure of the landing gear



Receiver Position and SPL Variation around the landing gear