講演番号	016

Study on Acceleration Noise Reduction Methods by Suppressing Vibration of Cantilever-Supported Heat Shield

Yonai Yu[1)]

1) UD trucks Co.Ltd 1-1 Oaza Ageo, Ageo, Saitama, 362-8523, Japan

KEY WORDS: Vibration, Noise, and Ride comfort, Acceleration noise, Finite element method (B3)

Exterior vehicle noise has become an important issue in urban environments, and the UN/ECE R51-03 regulation requires noise reduction under acceleration conditions close to actual driving. A heat shield installed around the intake and exhaust system is necessary to protect surrounding components from radiant heat, but it is often made of thin sheet metal and can become a noise source when vibration is amplified under resonant conditions. In this study, the relationship between a cantilever-supported heat shield and acceleration pass-by noise was investigated, and a vibration reduction method using a sandwich-structured heat shield was evaluated.

First, pass-by noise tests based on UN R51-03 were conducted to compare the vehicle with and without the heat shield. The results showed that the heat shield increased noise in specific frequency bands. Then, a frequency response analysis using FEM was carried out to identify the vibration behavior of the heat shield. Resonance peaks were observed around 344 Hz, 396 Hz, and 555 Hz, corresponding to the frequency bands where the measured exterior noise increased. These results indicated that the resonant vibration of the heat shield significantly contributed to pass-by noise.

To reduce the vibration response in the target frequency range, an updated heat shield with a sandwich structure was developed. The concept of the new structure was to increase damping while maintaining sufficient stiffness, heat resistance, and durability under severe vibration input and high-temperature conditions. FEM analysis of the updated heat shield predicted a clear reduction in acceleration response at the target frequencies compared with the original design.

Finally, vehicle tests were conducted using the updated heat shield. The measured pass-by noise results showed improvement in the corresponding frequency bands even when test variation was considered. Since the heat shield was the only structural change between the original and updated configurations, the observed noise reduction was attributed mainly to the suppression of heat shield vibration. These results confirm that resonance suppression of a cantilever-supported heat shield is an effective approach for reducing acceleration pass-by noise.

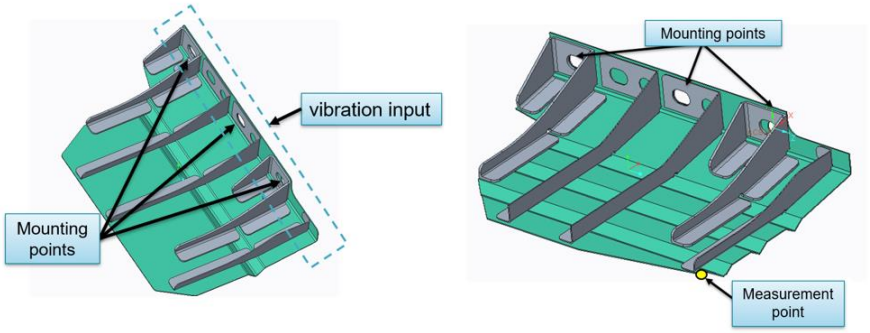

Figure 1 Old part on the left and updated part on the right

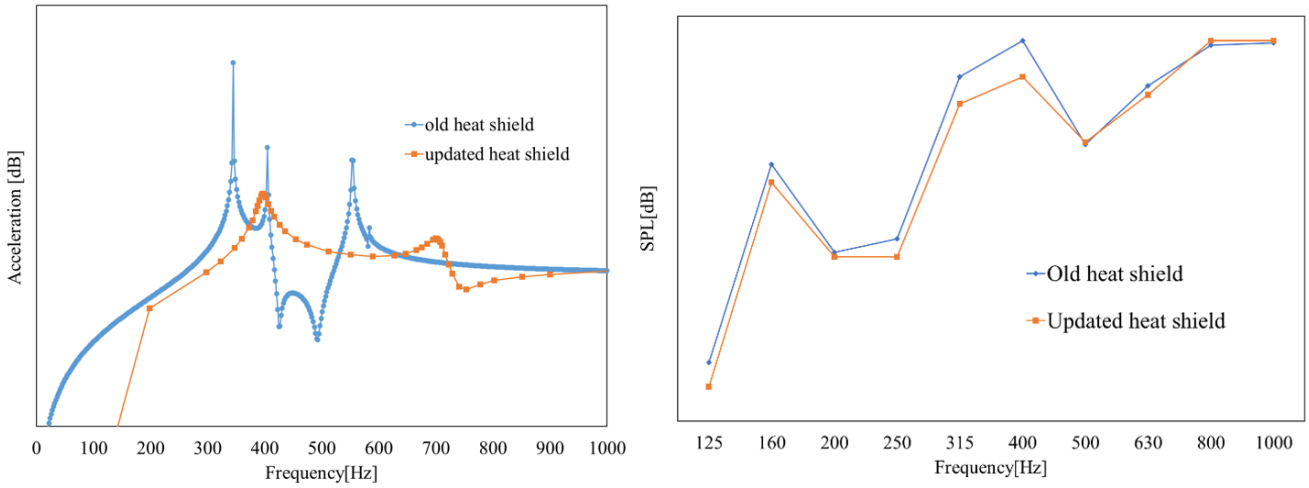

Figure 2 FRF comparison between the original and updated heat shields on the left, and pass-by noise comparison on the right.