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Effects of mounting positions and boundary conditions on the sound transmission loss of panels in a niche

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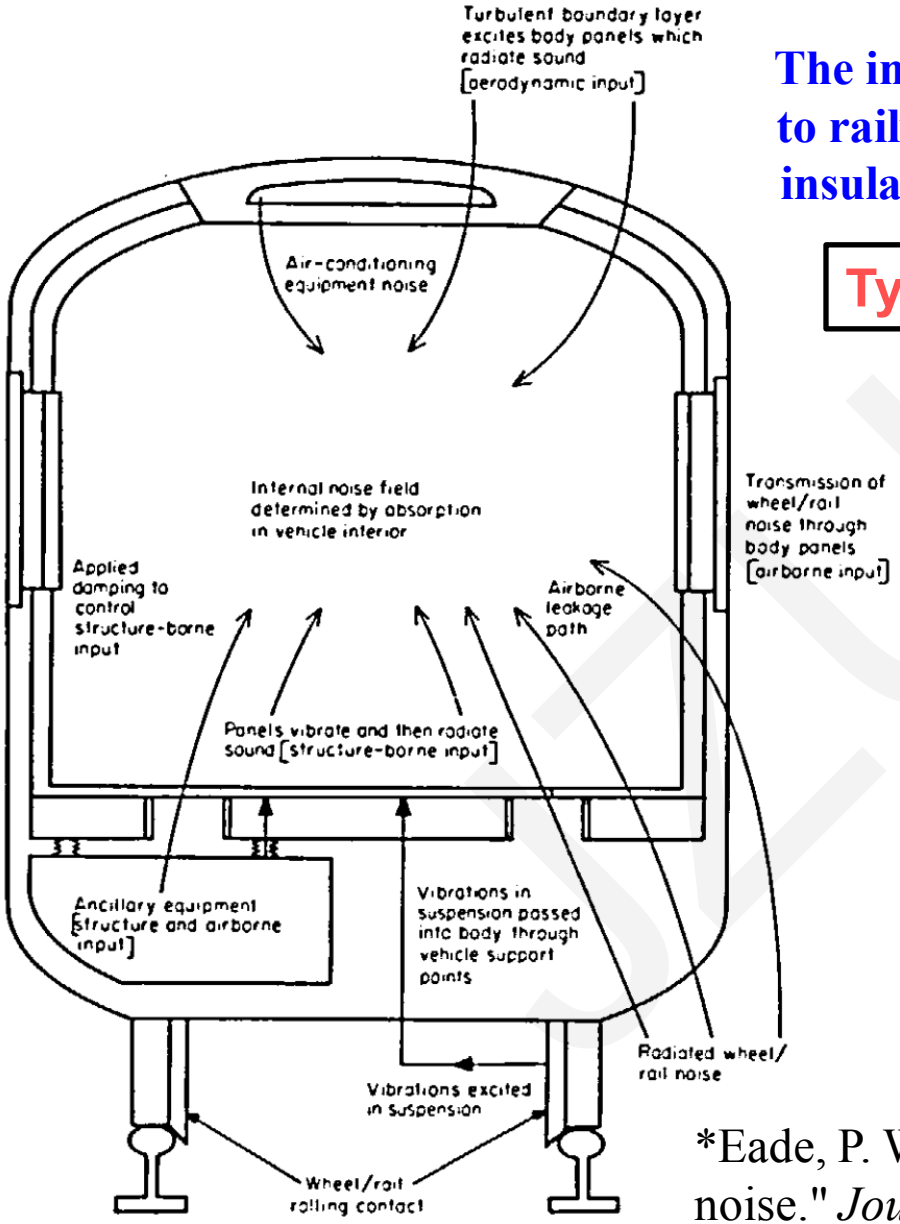
Background



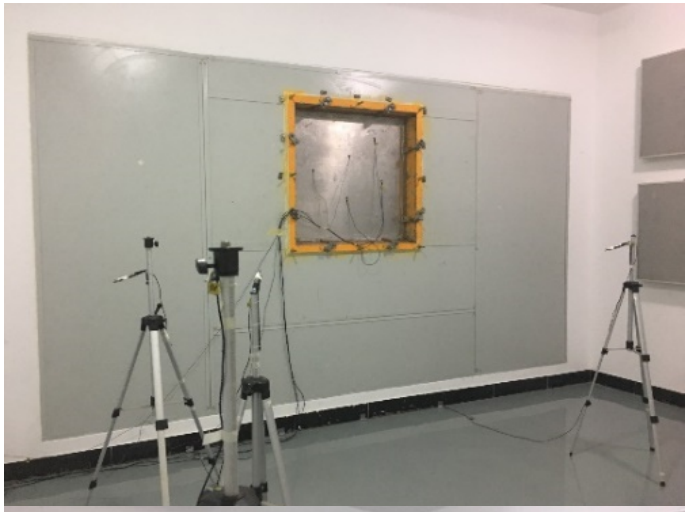
The interior noise of railway vehicles is closely related to railway panel structures, it is critical to study noise insulation characteristics of railway panel structures.

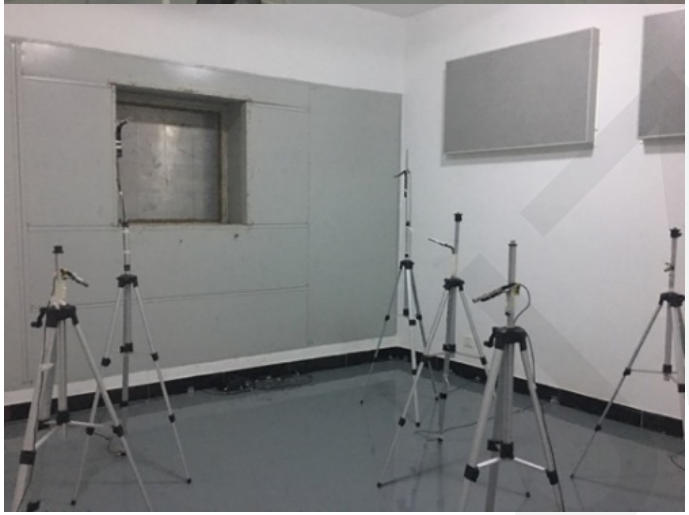
Typical railway vehicle floor structures



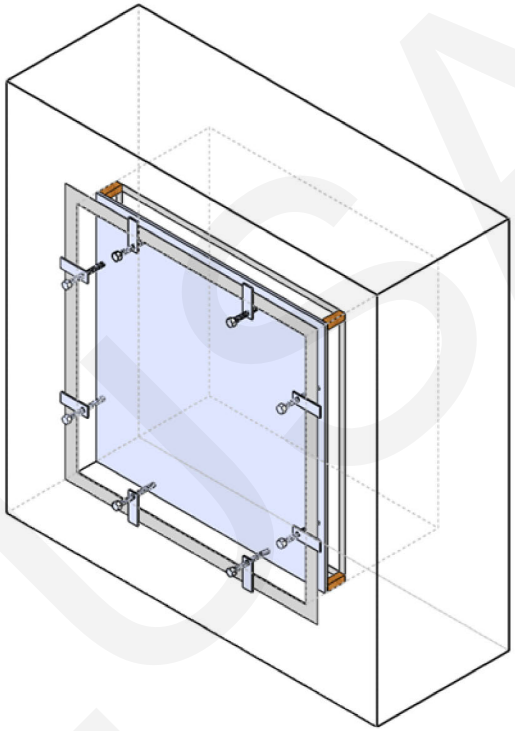
*Eade, P. W., and A. E. J. Hardy. "Railway vehicle internal noise." *Journal of Sound and Vibration* 51.3 (1977): 403-415.

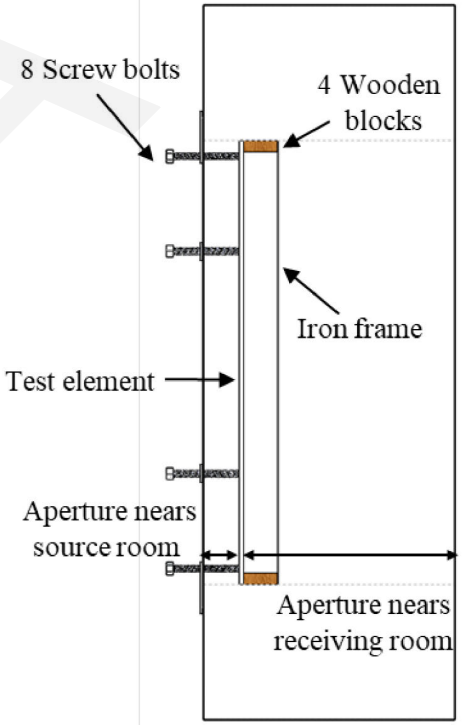
STL measurement set-ups





Rooms for the STL measurements



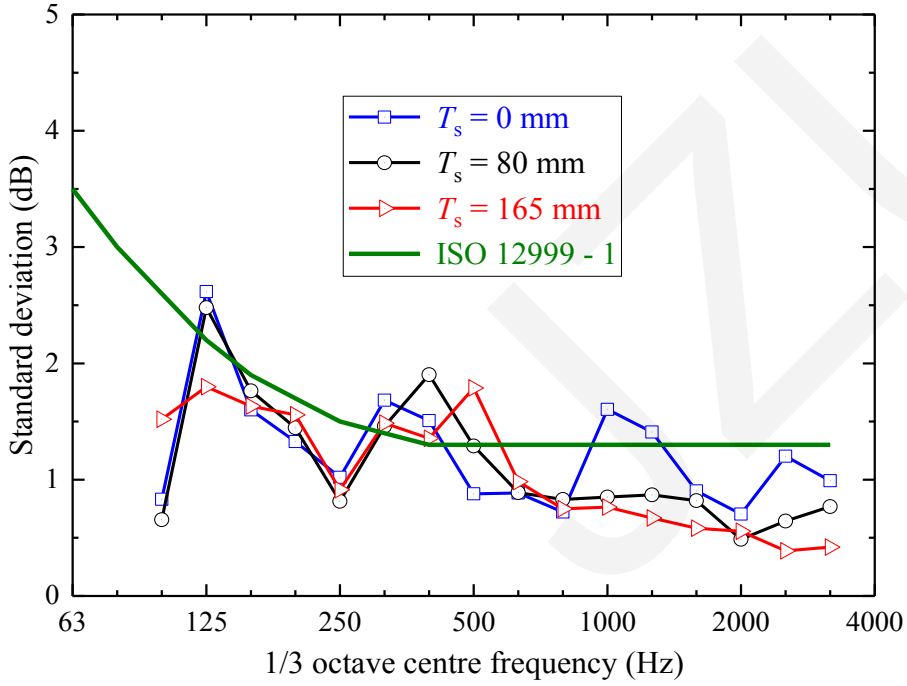


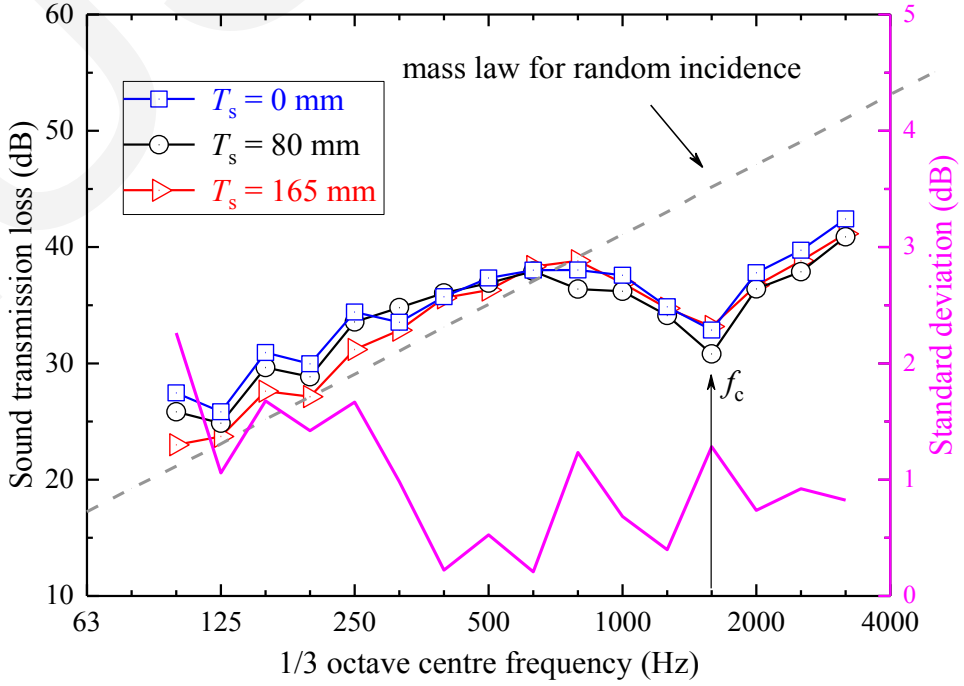
In sound transmission loss (STL) measurements, the test results will be significantly influenced by different mounting positions and boundary conditions..

Measurement results

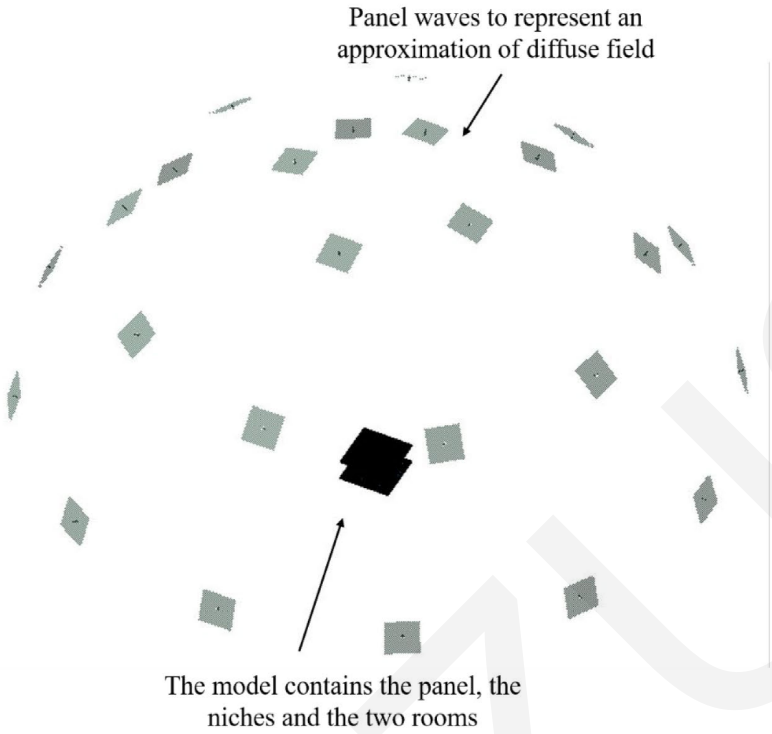
STL results for the aluminium panel

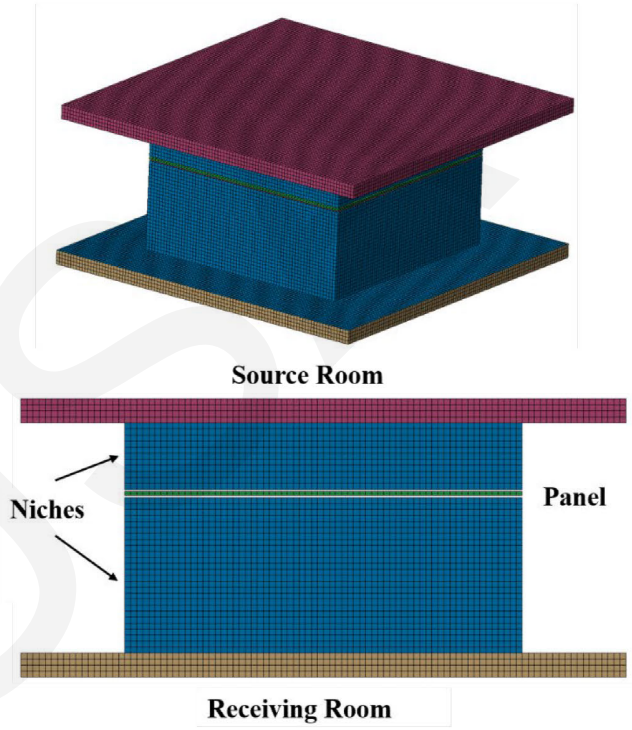
Test Conditions	Mounting positions			Boundary conditions	
	T_s (mm)	h (mm)	T_r (mm)	Restraints on the source room side	Restraints on the receiving room side
Condition 1	0	10	550	8 screw bolts	4 wooden blocks
Condition 2	80	10	470	8 screw bolts	4 wooden blocks
Condition 3	165	10	385	8 screw bolts	iron frame

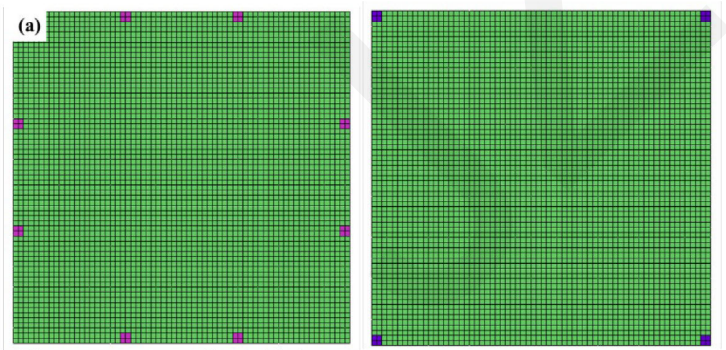




STL prediction model

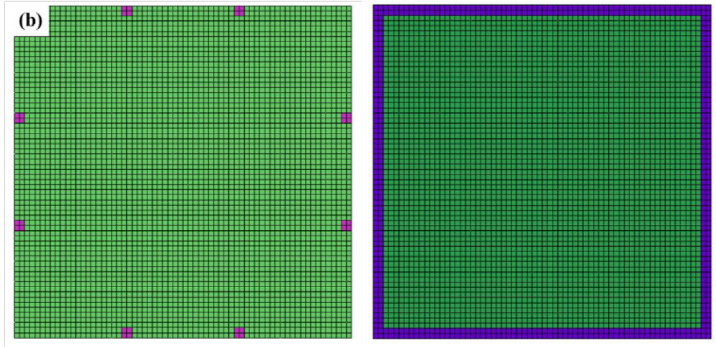






Elements corresponding with the screw bolts, facing the source room

Elements corresponding with the wooden blocks, facing the receiving room

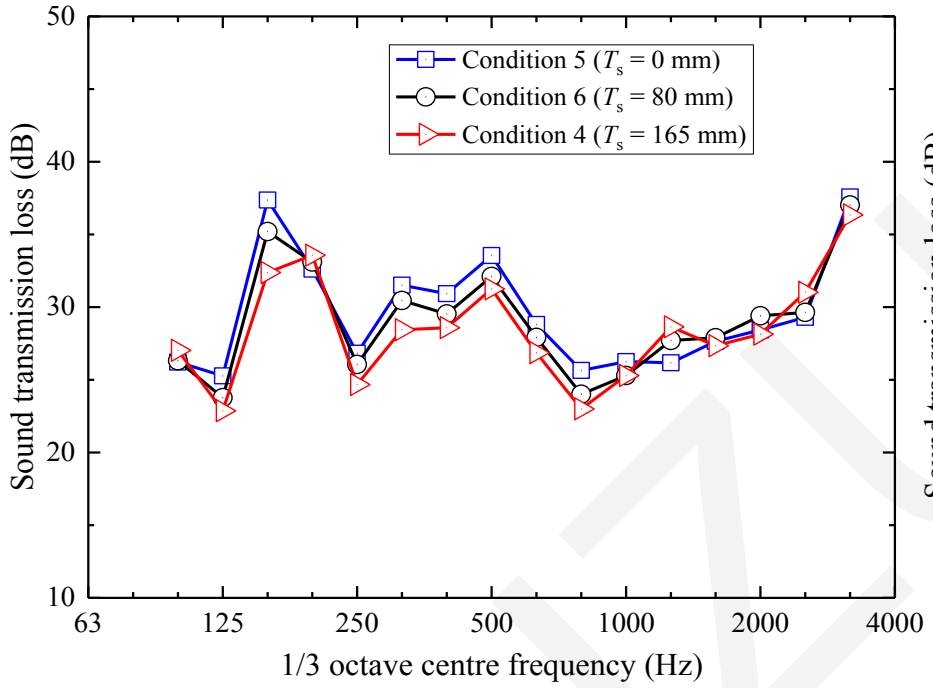


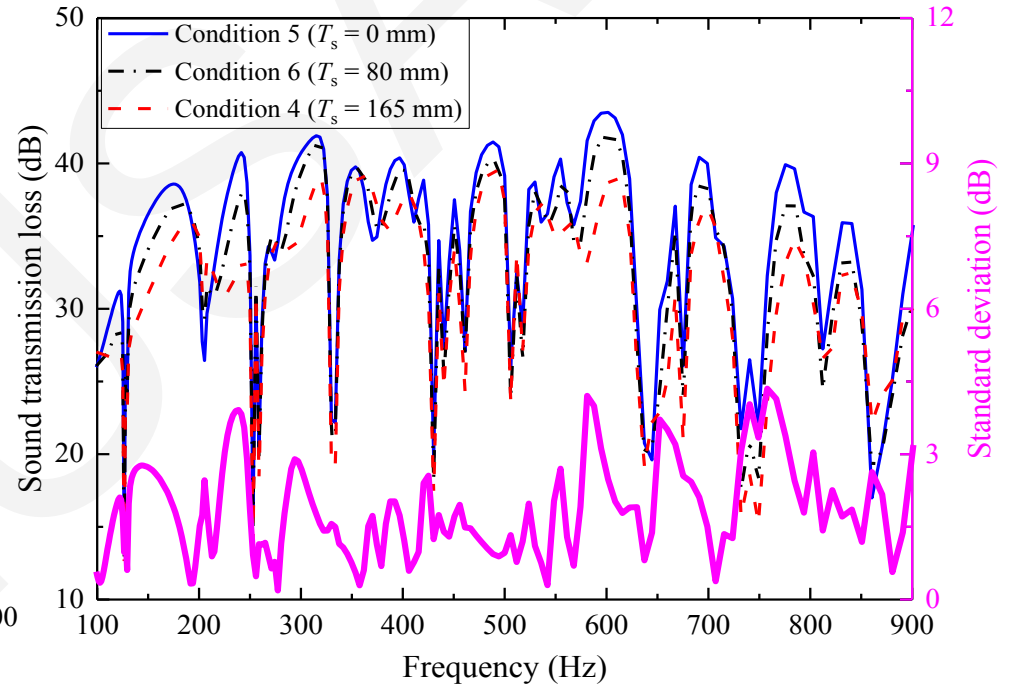
Elements corresponding with the screw bolts, facing the source room

Elements corresponding with the iron frame, facing the receiving room

Results and discussion

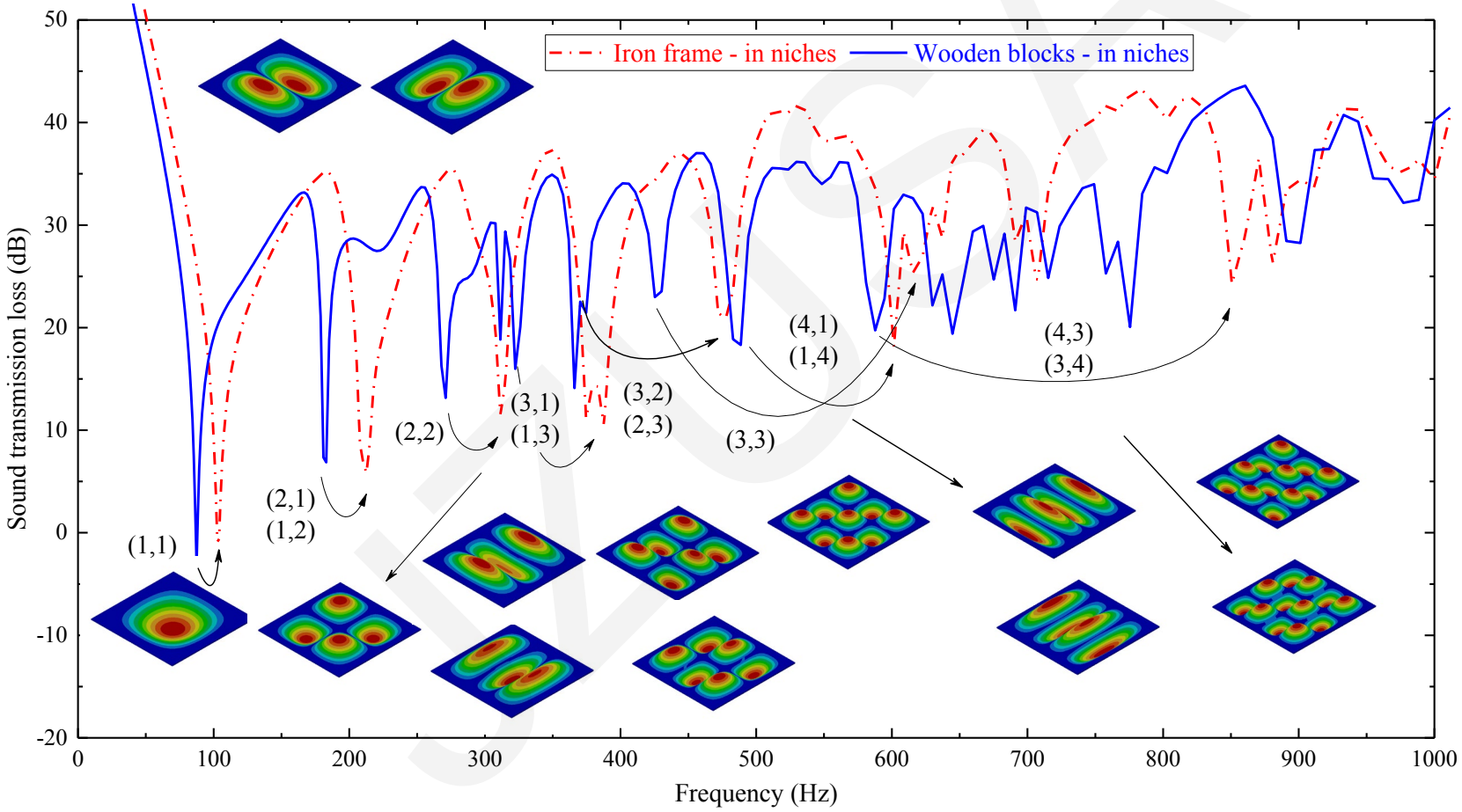
Effects of the mounting positions





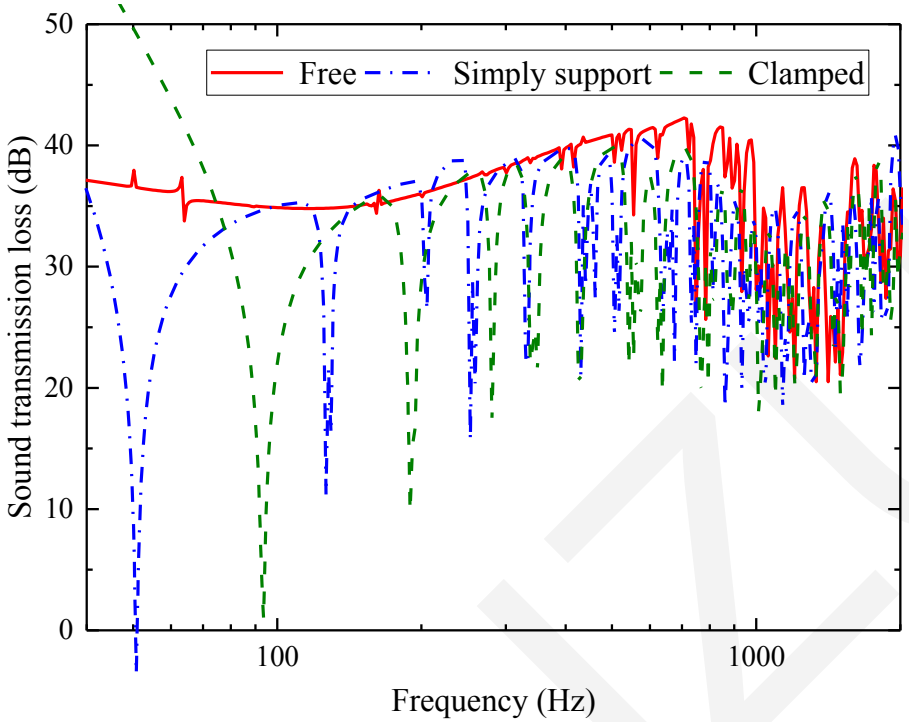
Results and discussion

Effects of the boundary conditions

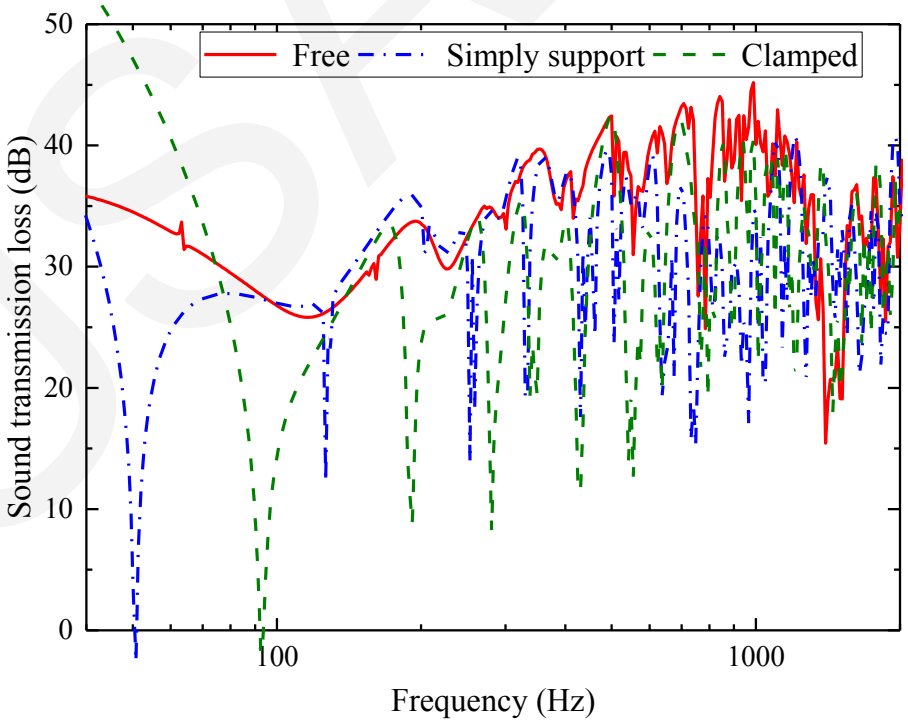


Results and discussion

Effects of the cavity and the boundary conditions



STL results for the baffled panel



STL results for the panel in niches

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Conclusions

- In this study, two typical interior floor panels are tested in a series of mounting conditions and mechanical boundary conditions.
- The change of STL results during measurement is also predicted by an STL prediction model based on the finite element method.
- At lower frequencies, the STL results are influenced by both the mounting positions and the mechanical boundary conditions. At higher frequencies, the STL results are mainly influenced by the mechanical boundary conditions.
- Considering both the effects of mounting positions and mechanical boundary conditions, the existence of the cavity amplifies the STL difference caused by the mechanical boundary conditions.

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