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Assessment of on-board sound insulation in the low frequency range using an experimental laboratory methodology based on the modal approach

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In recent years, a growing need has been observed in marine acoustics for the characterisation of low frequency materials below 100 Hz, particularly between 50 Hz and 100 Hz. The problem of sound insulation from airborne and low-frequency impact noise is becoming more and more relevant due to the considerable impact of sound sources at these frequencies, such as audio and video systems in theatres and discos, and TV systems inside cabins.

Current measurement procedures for identifying the sound insulation properties of bulkheads and floors are not sufficient to ensure repeatable and reproducible measurements, as their accuracy and precision values are too low to be accepted when applied at frequencies below 100 Hz. In fact, at low frequencies and in ordinary laboratory or room volumes (volumes between 40 m3 and 80 m3), the acoustic field is no longer diffuse due to the dominant presence of standing waves or resonant modes, which cause wide fluctuations in sound pressure level in space and frequency.
This study proposes and applies an experimental methodology based on the modal approach to study the low-frequency sound insulation phenomena below 100 Hz in the marine field.
Extensive experimental activity was conducted at the CETENA laboratories in Riva Trigoso, which made it possible to validate the measurement procedure and compare it with classical theories of sound transmission.

The development of this approach ensures significant support in the design phase for the optimisation of on-board sound insulation characteristics.

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