ANTI-RATTLE SYSTEM LOUDSPEAKER DEVICE

Dario Cinanni, Carlo Sancisi

1ASK Industries Spa, subject to direction and coordination of JVCKENWOOD Corporation
via Dell’Industria, 12/14-16 - 60037 Monte San Vito (An) - Italy
Correspondence should be addressed to author (cinanni@askgroup.it)

ABSTRACT

On the basis of loudspeaker cabinets and panels vibration problems, this study deals with a new dynamic loudspeaker device capable to reduce mechanical vibrations transmitted to the panel where it is fixed. Virtual 3D prototype is designed and optimized by simulations. Simulations were carried out using analytical and finite element methods. A working prototype was realized, measured and then tested on a panel, in order to evaluate vibrations reduction.

1. STANDARD LOUDSPEAKER MODEL SETUP

Firstly, a standard woofer was implemented, using a ferrite magnetic assembly, steel basket, rubber surround and a paper cone.

Loudspeaker 3D design was imported in COMSOL, solved for the magnetic field and structural mechanics physics.

Real loudspeaker prototype moving parts were measured using a laser on membrane center along its axis movement.

Displacement @5V is used to compare measured and simulated amplitude.

2. ANTI-RATTLE LOUDSPEAKER SYSTEM DESIGN

A loudspeaker with Anti-Rattle structure in a mechanical system can be identified as a TMD (Tuned Mass Damper) with 2-DOF (2 degree of freedom).

The closed box has high mass panels that for a 4W measurement it’s possible to consider the transducer mounted on an infinitely rigid panel.

Turning on Anti-Rattle system the THD measurement shows a different behavior in the frequency range 100 - 500 Hz.

Changing Anti-Rattle phase the THD measurement shows a complementary behavior in the same frequency range.

Eigenfrequencies structure simulation shows the first 4 modes in the range 246-446 Hz.

CONCLUSIONS

Anti-Rattle system doesn’t represent a loss factor for loudspeaker acoustic performances. On the contrary it helps transducer eliminating structure vibrations. The first developed prototype reveals about 50% of panel vibrations reduction. But the latest simulations show the way to improve these results.

Used tools: Comsol Multiphysics for FEM simulations, Solidworks for 3D design, Spendor/Audio VC for voice coils calculations, Kipster for anechoic measurement, Laser scanner/Vibrometer developed by ASK.