

REDUCTION OF NOISE AND VIBRATION IN BUSES

Development and implementation of NVH systems

H2020 SOCIETAL CHALLENGES: Smart, green and integrated transport

PRODUCTIVE SECTOR: Transport

PROBLEM

DESCRIPTION

Bus manufacturer Castrosua was interested in reducing noise inside the passengers' cabin, and minimizing the vibrations acting on the vehicle structure.

CHALLENGES

AND GOALS

To guarantee the passenger comfort and the structural reliability of the vehicle, by reducing the inner noise and by minimizing the vibrations.

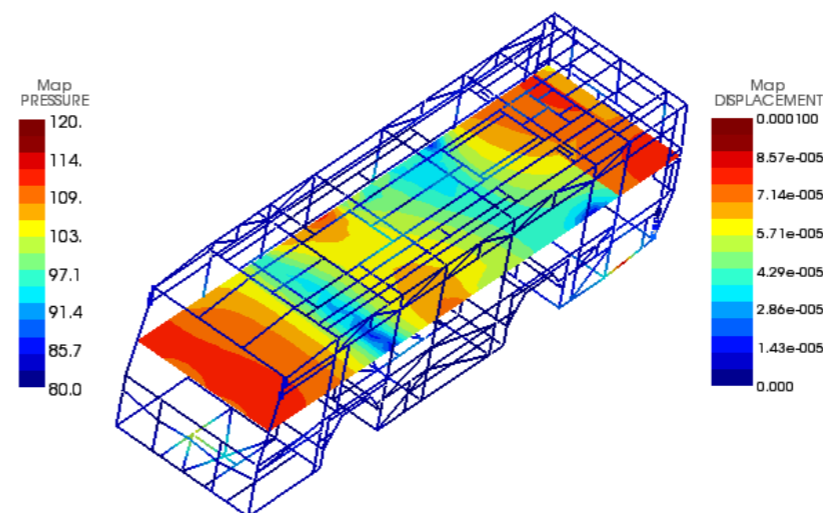
To reduce cost and time of vehicle design cycles by evaluating vibro-acoustic properties.

MATHEMATICAL AND COMPUTATIONAL METHODS

Firstly, the mathematical modeling of the vehicle was based on fluid-structure interaction, using fluid modeling for the passenger cabin and beams and plates for the vehicle structure.

Secondly, a finite element analysis was performed to obtain an approximate solution of both the sound pressure in the passenger cabin and the displacements in the structure. This process, accomplished by means of CAD/CAE tools and specific simulation software, can be split up into three different steps: reproduction of the geometry of the bus, meshing of this geometry, simulation of the physical problem and analysis of the results.

Finally, numerical simulations aimed to assess the effectiveness of a variety of geometric configurations, different materials, etc. in order to give advice the company to tackle the vibro-acoustic related problems.



Numerical simulation of the acoustic-structural model

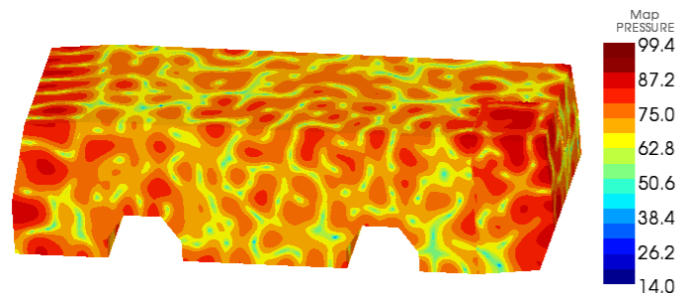
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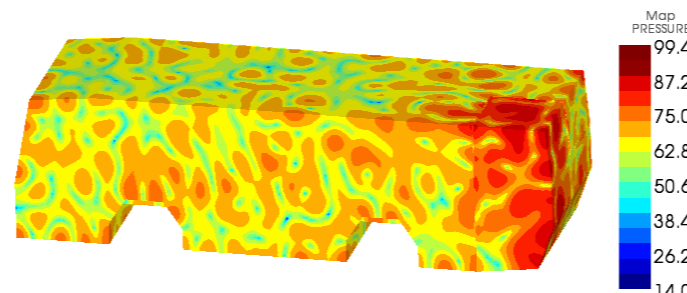
Results and Benefits

The straight result is the identification of vibro-acoustic problems at the design stage. Once these points are analyzed, different acoustic solutions based on passive coatings of absorbent materials have been proposed, as well as a variety of geometric configurations. Furthermore, a new vehicle configuration with new materials and a distribution of patches of absorbent multilayer materials has been developed.

The company has a computational methodology to predict, design and optimize the acoustic behavior of their vehicles



Numerical simulation of the sound pressure at 500 Hz



Numerical simulation of the sound pressure at 500 Hz after applying passive coatings