

Case Study: Renault

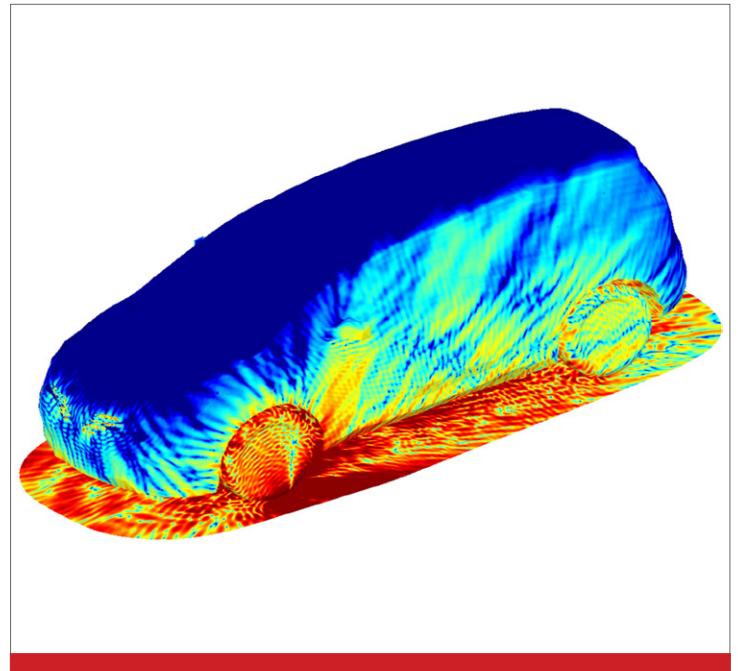
MSC Software Helps Renault Reduce Pass-by Noise

Based on an interview with: Philippe Mordillat, NVH CAE Expert – Methodology Development at Renault
Cécile Dutron, NVH Numerical Method Engineer – Methodology Development at Renault

Overview

In recent years, there has been a global initiative to reduce traffic noise and improve comfort in automotive vehicles. Engineers have to meet stringent government regulations while still improving the passengers' experience. One requirement involves a measurement procedure commonly referred to as Pass-by Noise. The maximum allowed sound level for Pass-by Noise has recently been reduced, now representing a new constraint on the design of commercial vehicles. Countermeasures to reduce noise emissions consist in moderating the different acoustic sources by either acting on the noise generating mechanisms or managing the noise propagation. Adding sound absorbing materials or modifying parts of the vehicle geometry are solutions that engineers are investigating to solve this problem.

With its wide range of vehicles, the Renault team has to anticipate the evolution of Pass-by noise regulations and design vehicles according to future constraints. Renault decided to extend its acoustic simulation capabilities and model the exterior acoustic propagation using Actran, a product of FFT, an MSC Software Company. With Actran, Renault was able to improve their designs and reduce development costs by considering the vehicle acoustics early in the design phase.



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Philippe Mordillat, NVH CAE Expert – Methodology Development at Renault

Challenge

As for many professionals in the automotive industry, Philippe Mordillat and Cécile Dutrion know the challenges that lie ahead of any Noise, Vibration, and Harshness (NVH) team. “There have already been changes in the level of the emissions and the way the regulation needs to be achieved,” said Philippe Mordillat, NVH CAE expert at Renault Methodology development department. “The noise level we need to achieve is getting more severe. By 2020 there will be a first step of noise level reduction and by 2024 another step of reduction!”

To ensure the vehicle passes regulations, actions need to be taken very early in the development process. “We need to preserve some space in the packaging of the car to ensure that the absorbing material fits within the vehicle,” said Philippe. “If we do not reserve this space right now it will not be possible to pass the regulation.” In this respect, simulation has been identified as

the solution to be investigated by Philippe Mordillat’s team. The objective was to develop a CAE approach for simulating Pass-by noise regulation. “We wanted to have a generic approach valid for any kind of vehicle. We needed to have a prediction method for both the acoustic sources and transfer functions from these sources to the regulation microphones,” Philippe explains. “We had a benchmark when we started investigating this kind of simulation. Following this evaluation, we concluded that Actran had all the capabilities we wanted to include for our simulation.”

Solution

Even with Philippe’s 20 years of experience in numerical simulation, he expected to have a rough time given the ambitious scope of the project. “We were thinking we would reach a limit in the size of the problem we wanted to address, both in terms in dimensions and frequency,” he said.

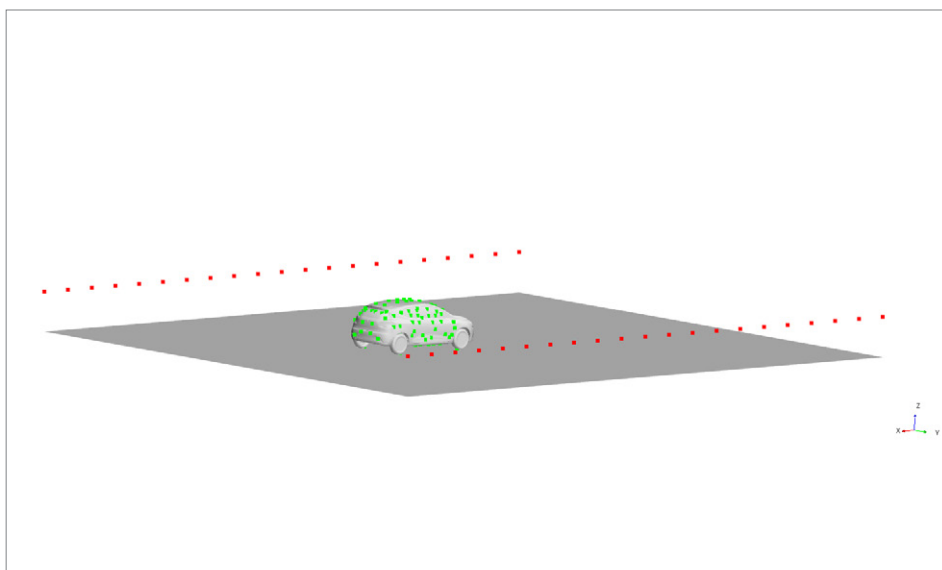
Key Highlights:

Product: Actran

Industry: Automotive

Challenge: Anticipating design requirements to meet pass-by noise regulation.

Benefits: Reducing development costs by integrating acoustic constraints at early stages through simulation.



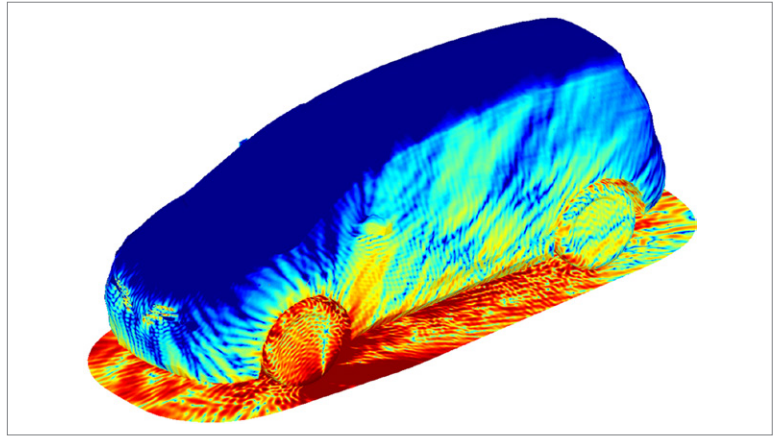
Actran Model for Pass-by Noise Numerical Evaluation

“Finally, thanks to Actran’s software methodology and HPC, we were able to achieve our goal. Another strength we discovered later was the quick turnaround time for performance increase development requests” he added.

In regards to the details of the Actran model, Cécile Dutrion, NVH Numerical Method Engineer in Philippe Mordillat’s team explains: “We are considering noise sources from the engine, the tire to road contact, the exhaust line, and the air intake,” she said. “We calculated the transfer functions between sources and regulation microphones. Sources were evaluated by other calculations or by measurements. This gave us flexibility to try different combinations of sources and acoustic transfer functions.”



Pass-by Noise Measurement Setup



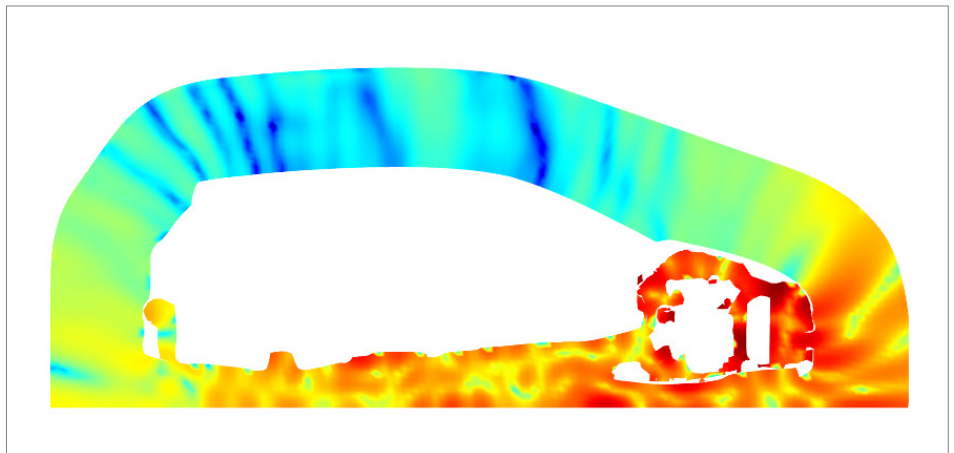
Acoustic Radiation of Tire Noise at 5000Hz

The objective of the project was to develop a generic approach for any kind of vehicle and be able to check every vehicle. The computational performances aspect is therefore extremely important. "The exterior acoustic component with automatic meshing adapting to frequency is an extremely useful feature," Cécile said. "Thanks to Actran, we were able to divide by 5-7 the run time of the engine radiation case," Philippe adds. "Initially we were thinking about calculations up to 2000Hz, we thought 5000Hz was only a dream, but in the end it became possible."

Results

When studying Pass-by noise, it is essential to make sure that the numerical simulation is accurate. The absolute sound level recorded during the test determines if the vehicle will pass or if it will be rejected. "We had some measurements from physical testing available when we started the validation," Philippe explains.

"When we started the project we were quite far, we needed to analyze the results and understand the problems in the way we were modelling. Now we are quite happy with the results. We went quite fast in improving the accuracy."



Engine Acoustic Radiation (Cut View)

Following this successful validation phase, the methodology is now used daily by Renault engineers to optimize the technical definition of the vehicle to be sure that absorbing materials will be placed exactly where needed. "Compared to the initial target, we achieved much better performances. We started from scratch for this exterior acoustic problem, and what we were able to achieve in just a couple of years in this project is quite impressive to me" concludes Philippe.

About Renault

The Renault group is an international company based in France with a more than 115 years' history. Present in 128 countries, Renault designs, manufactures and markets private vehicles and commercial vehicles. More than 120,000 employees work for Renault around the world, all driven by the same passion: the automobile.

For more information on Actran and for additional Case Studies, please visit www.mscsoftware.com/actran