

Case Study: **Scania**

MSC Software helps Scania Reduce Cabin Noise in Trucks

Based on an interview with: Per-Olof Berglund, Senior Engineer – Complete Vehicle Acoustics at Scania

Overview

Having a pleasant driving experience is a key determinant when purchasing or driving a vehicle. For companies buying trucks and for truck drivers, it is also a matter of health and productivity. Most drivers spend more than 8 hours a day in the truck cabin. High noise levels or unpleasant sounds in a working environment are known to cause excessive fatigue and health problems. It is therefore crucial for truck manufacturers to carefully design their new products and shape the cabin noise to go beyond the requirements of their customers, and propose the most enjoyable driving experience possible.

With a wide range of premium trucks, Scania, one of the world's leading truck manufacturers naturally aims at designing trucks with outstanding comfort and performance. Scania's Complete Vehicle Acoustic Department is focused on getting their vehicles up to speed with today's drivers' expectations by addressing the level and quality of cabin noise in their vehicles. The development for more optimized cabins is supported by extensive testing and the introduction of new methods based on vibro-acoustic simulations. For this endeavor, Scania's development team chose to use Actran, a product of FFT, an MSC Software Company, to improve their designs and shorten their design cycles.



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Per-Olof Berglund, Senior Engineer – Complete Vehicle Acoustics at Scania

Challenge

With more and more stringent constraints on the design of new trucks coming both from legislative regulations and customers, new methods have to be developed to have a more robust and efficient design process. When it comes to cabin noise, “most of the activities at Scania are measurements and tests,” said Per-Olof Berglund, Senior Engineer at Scania Complete Vehicle Acoustic department. “We aim to use more simulations” Per-Olof added.

In order to replicate the sounds in the physical environment, the Scania team needed to understand what the different noise sources were and identify how they directly affected cabin noise. “For two years, a number of cross-functional simulation projects between several departments were started to get the complete picture of the noise in the cabin,” Per-Olof said. “We want to be able to design sound by adjusting contributions from different sources.”

The Complete Vehicle Acoustic department first had to narrow down the main contributors of cabin noise in the vehicle. They found that the main sources were wind noise, powertrain noise and rolling noise. They then identified the typical frequency content for each of these noise sources.

With this valuable information, the natural next step for Per-Olof and his team was to find a software solution that was able to predict all of these major noise sources, and the response of the cabin structure to these excitations.

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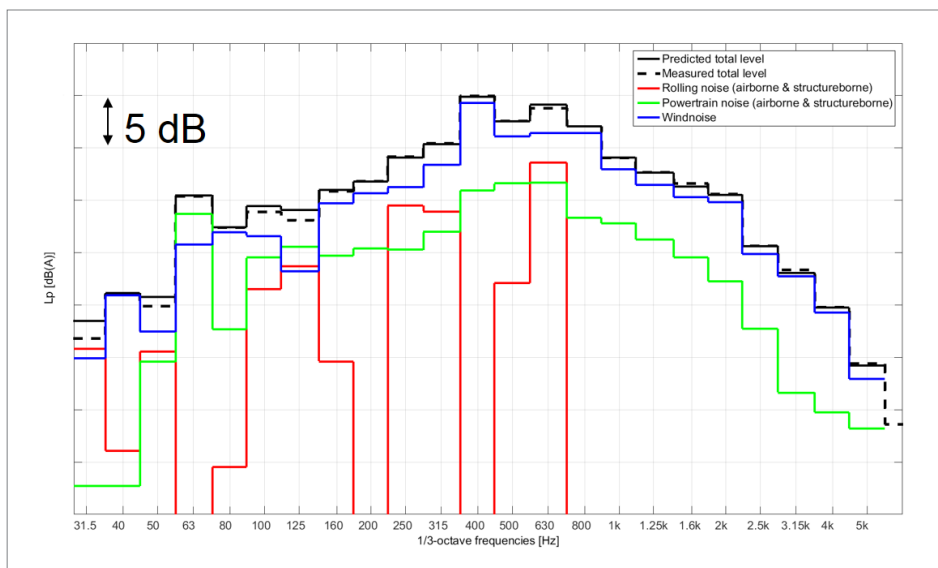
Key Highlights:

Product: Actran & MSC Nastran

Industry: Automotive

Challenge: Addressing the pain points Cabin Noise in vehicles, specifically for trucks

Benefits: Enhancing the design of the truck to prevent the negative effects of Cabin Noise

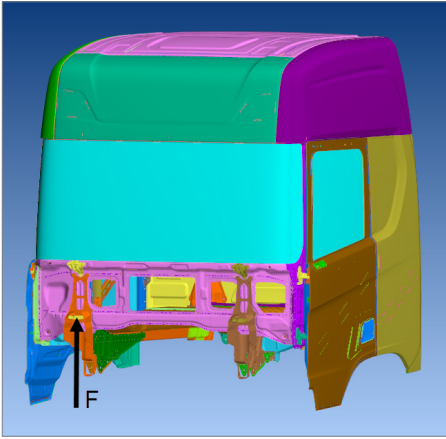


Sources ranking for Cabin Noise at 90 km/h

Solution

Per-Olof has been spearheading the Complete Vehicle Acoustic department efforts in developing new methods to address cabin noise at Scania. He started his work using MSC Nastran for structural dynamics and acoustics, specifically for powertrain noise and structure-borne noise in the cabin. As the need for more complex acoustic calculations emerged, he then chose to use Actran for its wide range of capabilities, such as accurately solving the response of the cabin including trim components.

“I started with airborne engine noise,” Per-Olof said. “From the engine department I have the node velocities computed by MSC Nastran. I use Actran to get the acoustic load on the outer surface of the cabin and finally, the noise inside the cabin.”



Simulation of structure-borne sound in a Scania truck with the use of Actran



The new Scania R450 Truck



Scania's Listening Studio for subjective evaluations

Per-Olof has also been working with the aerodynamics department to compute the wind noise at the driver's position based on CFD calculation results that his colleagues provided him. "The CFD results are mapped on the outer surface of the cabin and then, the results are computed inside the cabin using a Modal Frequency Response," Per-Olof added.

Per-Olof is currently working on creating models for exhaust noise and powertrain structure-borne noise. Once these models are completed, he will be able to simulate all of the main contributions of cabin noise.

Results

Scania aims to increasingly utilize Actran's simulations results to compare different designs and define the design directions early in the product development cycle, without the need for physical testing. To support this decision-making process, a listening studio was built at Scania. The studio is similar to that of a professional mixing studio. It encompasses a 7.1 surround system for sound and is designed to produce exactly the same listening experience for anyone who is seated in the center of the room. During subjective evaluation sessions, Per-Olof conveys to his fellow colleagues his findings based



Driver Environment

on his simulations. He combines test and simulation data to replicate the environment of driving an actual truck. This process helps managers to make important decisions, which will affect the design of the cabin. "It is a very different response from management when you can play a sound and they can have this subjective experience," Per-Olof said. "It's not really possible to understand from a graph what you will hear in the truck," he explained.

With the use of Actran in this new simulation process and the subjective evaluations allowed by the listening

studio, Scania now has all the tools needed to improve its customer driving experience even further, while having a more efficient design process.

About Scania

From its foundation in 1891, Scania's culture of continuous innovation and improvements has made it one of the world's leading manufacturers of heavy trucks and buses. Scania is a global company with a sales and service organization in more than 100 countries. Scania's production units are located in Europe, South America and Asia.

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

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