

## Simulating Squeak & Rattle Phenomena During the Development of a Truck Cabin



Left photo: Göran Wink, Scania 2010  
Right photo: Wagner Menezes, Scania 2013



### Key Highlights

#### Industry

Automotive

#### Challenge

Accurately simulate squeak and rattle noise within a truck cabin

#### Altair Solution

Deployment of Altair's Squeak & Rattle Director

#### Benefits

- Accelerated development time
- Improved product quality

Scania CV AB is one of the world's leading manufacturers of trucks and buses for heavy transport applications, and of industrial and marine engines. A growing portion of the company's operation consists of products and services in the financial and service sectors, assuring Scania customers have cost-effective transport solutions and maximum uptime.

Employing 32,800 people, Scania operates in around 100 countries. Research and development activities are concentrated in Sweden, while production takes place in Europe and South America, with facilities for global interchange of both components and complete vehicles. In 2012, invoiced sales totaled SEK 79.6 billion and net income amounted to SEK 8.3 billion.

Jan Söderlund, Head of Instrument Panel Development, selected LeanNova Engineering AB and Altair ProductDesign as partners to assist with the development process for a Scania truck cabin. The combined team were tasked with assisting with the virtual development process, ensure the liaison with suppliers' computer aided engineering (CAE) teams, and finally support elements of the testing process.

#### Challenge: Simulate Squeak & Rattle Phenomena Before Hardware

Squeak and rattle are two phenomena which may be observed when two parts of an assembly are in relative motion due to a specific excitation load. In the rattle case, the two parts are initially separated by a predefined gap and at occurrence of the

# Scania Success Story



**“Altair Squeak and Rattle Director has helped the Cabin Development Department to focus on the risk areas and make improvements very early in the design process, enabling consciousness of these issues at an early stage without hardware, and creating value to the end customer.”**

**Jan Söderlund**  
Head Instrument Panel, Driver Control Unit and Climate System  
Scania CV AB

phenomenon come in contact, creating a rattling noise. On the other hand, a squeak noise might be observed when two parts are initially in contact and a sufficiently large relative displacement is caused at the interface between them.

A typical example is in the automotive industry where these phenomena are studied in an attempt to reduce the cabin

noise and as a result, give a better ride quality and comfort to occupants.

In the case of Scania’s Cabin Development Department, this kind of simulation was not performed historically. The team had to rely on tolerance calculations as well as the choice of materials to reduce the risk of squeak and rattle. When first prototypes became available, iterations were made to

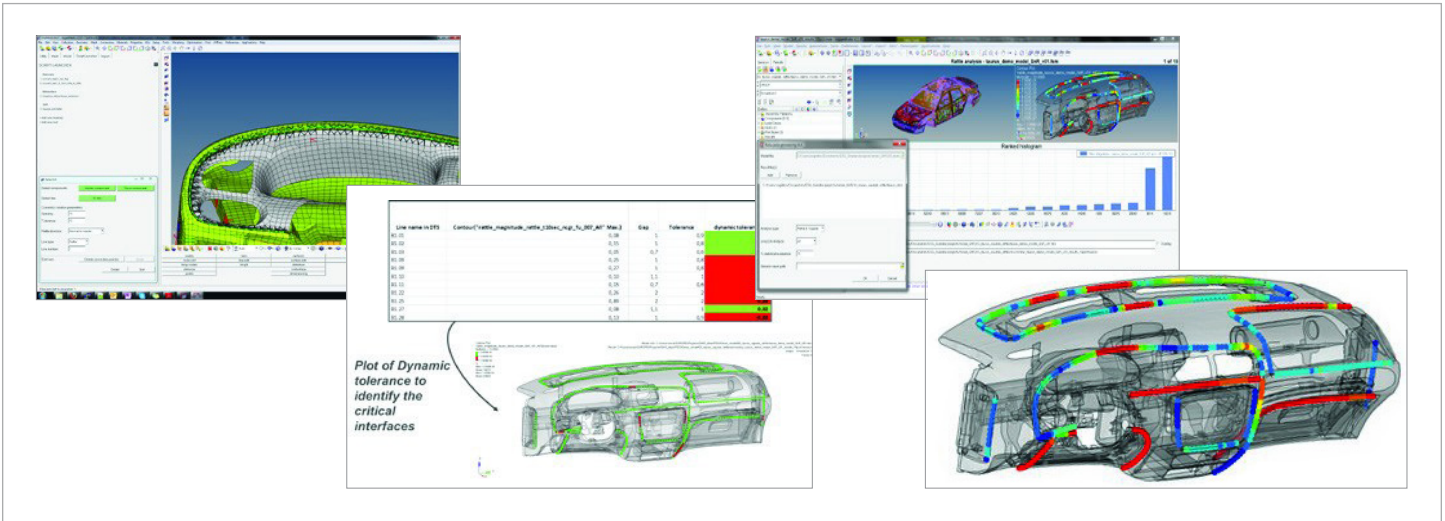
fix and correct the final design in order to solve the noise issues.

To reduce development time and cut down on iterative changes, a desirable solution was identified that enabled a simulation-driven design process during the early stages of the cabin development cycle.



Photo: Scania Archive 2006

Example model of a Scania CV AB truck cabin environment



Screenshots of the Squeak & Rattle Director in action

### Solution: Simulate using Squeak and Rattle Director (SNRD)

While both test and simulation methods can be used to analyze squeak and rattle noise, virtual engineering combines a variety of advantages. Simulations can be performed very early in the design process, leading to increased right first time designs and reduced need for physical testing. In addition, simulations can lead to significant time reduction, allowing engineers to perform more analyses in a timely manner and with limited resources.

Altair ProductDesign's domain expert, Ismail Benhayoun, presented the squeak and rattle simulation methodology, which was identified as a valuable tool to support the tolerance calculations performed by Scania's analysts. Part of his involvement was to perform simulations analyzing the risk of squeak and rattle noise occurring inside the cabin.

During a 16 month period, two full design loops and a number of design studies were performed on-site at Scania.

The first step involved modal correlation of the plastic parts from an existing cockpit in order to improve the material database for future simulations. The second step was to build up a full vehicle model for various types of cabin, and by applying loads from road test measurements, calculate the relative displacement at defined interfaces.

All of this work was conducted using Altair's Squeak and Rattle Director (SNRD), which empowers engineers to perform more simulations by reducing the time needed for analysis of squeak and rattle phenomena.

### Results: Improve Product Quality by Identifying Risk Areas

Using many calculation loops and continuous calculation iterations, the focus was to improve the performance for each system and then study the interfaces between these different systems.

The output from SNRD delivered valuable input for the designers to help find better attachments and boundary conditions to their parts. In addition, the tolerance

analyst benefits from the dynamic tolerance calculated in SNRD to include in the static tolerance calculation.

**“In our philosophy to use CAE driven development the Altair Squeak and Rattle Director (SNRD) has been excellent as a tool in this project,”** said Martin Öman, Chief Operating Officer at LeanNova Engineering AB. **“We have utilized it during the early design phase and the results are very visible and easy to communicate, giving the design engineers clear directions for implementing design changes.”**

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## About Altair

Altair empowers client innovation and decision-making through technology that optimizes the analysis, management and visualization of business and engineering information. Privately held with more than 2,000 employees, Altair has offices throughout North America, South America, Europe and Asia/Pacific. With a 25-year-plus track record for innovative product design and development, advanced engineering software and grid computing technologies, Altair has more than 3,500 corporate clients representing the automotive, aerospace, government and defense, and consumer products verticals. Altair also has a growing client presence in the life sciences, financial services and energy markets.

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## About Altair ProductDesign

Altair ProductDesign is a global, multi-disciplinary product development consultancy of more than 700 designers, engineers, scientists, and creative thinkers. As a wholly owned subsidiary of Altair Engineering Inc., this organization is best known for its market leadership in combining its engineering expertise with computer aided engineering (CAE) technology to deliver innovation and automate processes. Altair ProductDesign firmly advocates a user-centered, team-based design approach, and utilizes proprietary simulation and optimization technologies (such as Altair HyperWorks) to help clients bring innovative, profitable products to market on a tighter, more efficient time-scale.

[www.altairproductdesign.com](http://www.altairproductdesign.com)

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## About LeanNova

LeanNova Engineering is a newly established engineering service company situated in Trollhättan, Sweden, created by former engineers from Saab Automobile AB. Together with our main investor Fouriertransform AB, we are developing the company to compete internationally, mainly focusing on the automotive industry. We offer our customers excellence in development and integration of systems and attributes for complete vehicles. We have since the start-up in February 2012 employed more than 170 engineers with an average working experience of 15 years and we will continue to grow rapidly.

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