

Reducing Lead Time and Increasing Vehicle Quality with Squeak and Rattle Simulation



Key Highlights

Industry

Automotive

Challenge

Limited knowledge of S&R methodology prevented early issue detection.

Altair Solution

Suggested and trained the simulation team on Squeak & Rattle Director

Benefits

- More efficient product completion
- Earlier detection of product issues
- New capability added to company portfolio

Today's highly competitive automotive industry has pushed carmakers to invest heavily in ensuring that their products offer a high level of refinement to customers. Drivers now expect high quality standards regardless of the vehicle brand and often their perception of quality is encapsulated by the vehicle's interior. Any unexpected noise or lack of quality feel can seriously affect customer satisfaction, even leading significant warranty claims in some cases. To tackle this, squeak and rattle (S&R) in vehicle interiors has become a pain point for many automotive manufacturers and their suppliers.

Company Introduction

CalsonicKansei North America (CKNA), part of the global automotive parts manufacturer, CalsonicKansei Corporation based in Japan, creates a wide range

of automotive components including interior cockpits and center consoles. The company's goals to develop high-end, innovative products and to continuously improve cost competitiveness require that they are continuously evolving and improving its development processes. Computer aided engineering (CAE) plays a huge role in this capability. The use of CAE results in improved quality as well as reduced timing.

Challenge

Although hugely experienced in modern CAE techniques, CKNA had not fully explored the potential of using simulation technologies to investigate S&R issues before physical hardware production. Squeak and rattle are two phenomena which occur when two parts of an assembly

CKNA Success Story



"CalsonicKansei North America was able to utilize Altair's Squeak & Rattle Director to improve squeak and rattle in the center stack components of a cockpit module, which led to noise elimination. CKNA is currently doing an extensive correlation study on both the system and vehicle levels, and once it is completed a full procedure and methodology will be deployed globally across CalsonicKansei corporation. The study is expected to be completed in 2017."

Sal Maaita, Ph. D.
Senior Development Engineering Manager
VVG & Materials Engineering
CalsonicKansei North America

are in relative motion due to a specific excitation load. When two parts are initially separated by a gap but rapidly come into contact with each other, a rattling noise is created. On the other hand, a squeak noise might be heard when two parts are initially in contact and a sufficiently large relative displacement is caused at the interface between them.

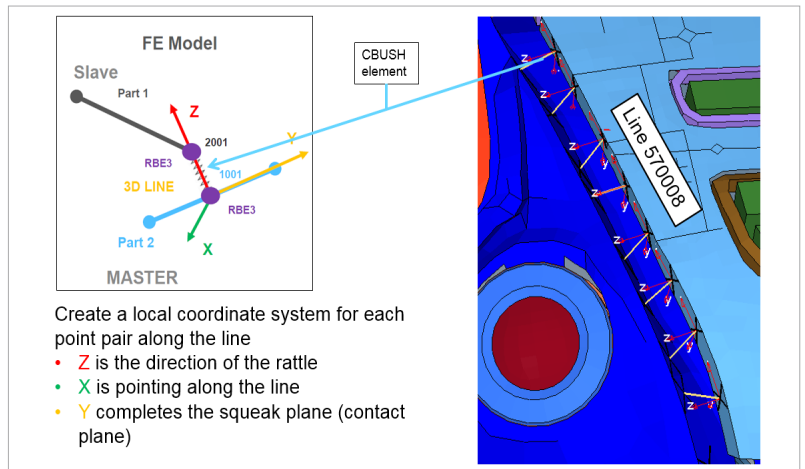
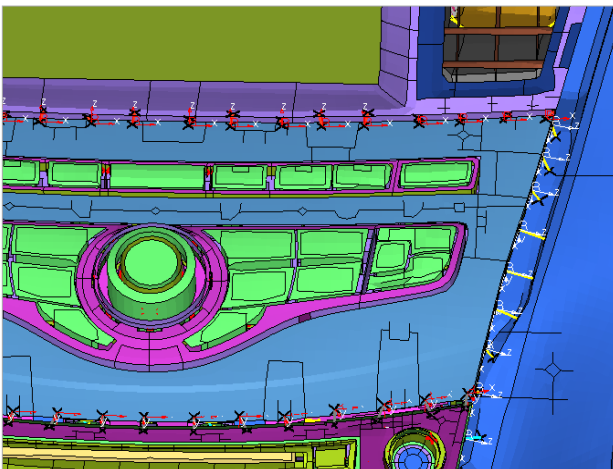
Altair ProductDesign (PD) has extensive experience analyzing squeak and rattle having studied the methodology extensively

and performed the simulation for numerous clients. These projects eventually led to the development of the packaged solution, Squeak & Rattle Director (SnRD). SnRD is a comprehensive set of software automations that rapidly identify and analyze design alternatives to eliminate the root causes of squeak and rattle in assemblies.

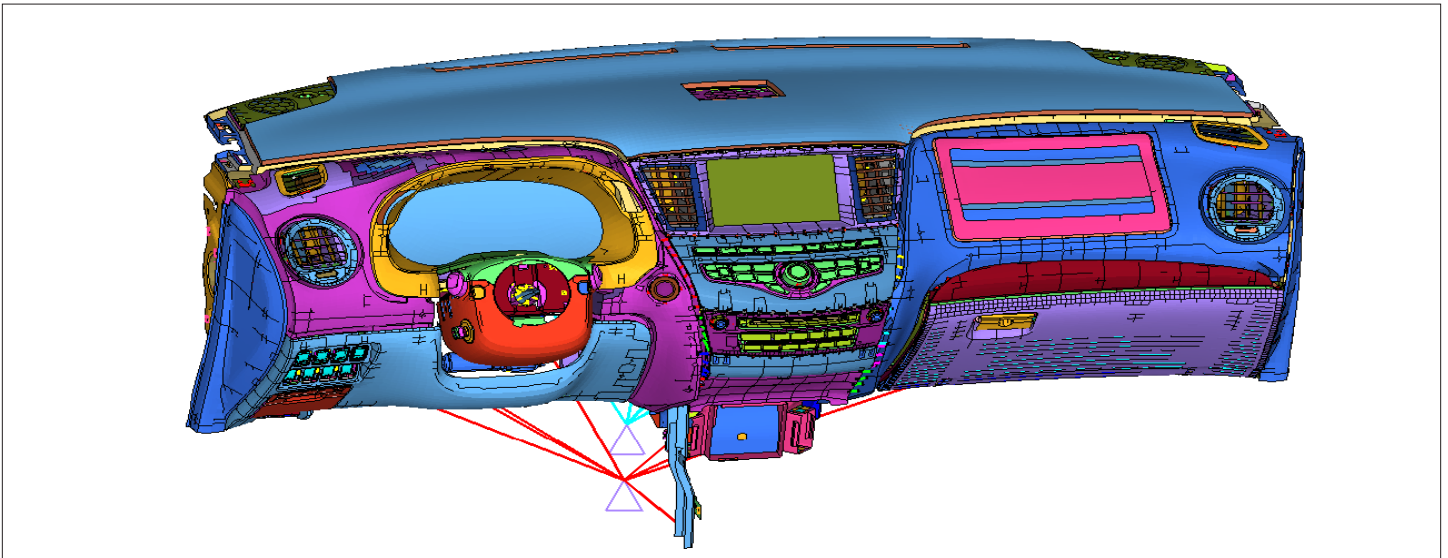
Solution

CKNA first contacted Altair for a training on the SnRD, with intentions of proceeding

in developing their own custom process for the analysis. Over time, and several informational meetings with Altair PD later, the companies mutually decided to work together to achieve more significant progress, faster. CKNA had squeak and rattle issues in some of their products and Altair was able to offer the SnRD as well as insight into the methodology of squeak and rattle to better help them correlate their simulation results with the actual performance of the products being developed. Altair was also able to



Transient Analysis Element Line Creation



Input Displacement vs Time

provide perspective on the prerequisites required for such analyses, including which modeling techniques should be used, how to increase the fidelity of the finite element (FE) models, what kinds of loads should be applied, which methods are appropriate for correlation and prediction, etc. Another important aspect that should be considered is the correlation of the material data from the component to the system level and providing processes on how to do that with the help of CKNA's test department and by applying simulation earlier.

All of this information was provided to CKNA by working jointly on a cockpit project. Each step of the modeling, simulation and test results analysis was completed hand-in-hand by the two companies, wrapping up with a two-day onsite workshop with the CKNA Squeak and Rattle team led by Elizabeth Patterson.

Results

With Altair PD's help on the cockpit project, CKNA was able to recognize how their existing FE models could be improved in the frame of the SnRD process, enhancing the fidelity and better capturing the reality. This was beneficial for S&R analysis but also improved the correlation for other load cases like Frequency Response Analysis, which is part of standard load cases performed by the CKNA CAE team.

In addition to simulation results, Altair was also able to provide tailored scripts to jumpstart a robust process at CKNA, including how to create loads from frequency to time domain and the method of correlating between test and simulation data. The new process included the consideration of material data and damping as well, both pieces which were lacking in their process before. In addition

to gaining knowledge of the squeak and rattle methodology, CKNA learned how to improve FE model fidelity through better correlation. CKNA also learned how using SnRD to detect squeaks and rattles earlier in the development process can improve the overall final product design.

Coming away from this experience, CKNA can cut project development time considerably and potentially gain more clients than previously possible by adding the squeak and rattle CAE based prevention methodology and simulation capability to their portfolio of services. Now that they are aware of the possibilities associated with analyzing squeak and rattle early in the process, they will continue to gain experience by working with Altair to expand that knowledge with complementary methods for future projects.

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About Altair

Founded in 1985, Altair is focused on the development and application of simulation technology to synthesize and optimize designs, processes and decisions for improved business performance. Privately held with more than 2,600 employees, Altair is headquartered in Troy, Michigan, USA with more than 45 offices throughout 20 countries, and serves more than 5,000 corporate clients across broad industry segments. To learn more, please visit www.altair.com.

About Altair ProductDesign

Altair ProductDesign is a global, multi-disciplinary product development consultancy of more than 800 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 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

About HyperWorks

HyperWorks is an enterprise simulation solution for rapid design exploration and decision-making. As one of the most comprehensive, open-architecture CAE solutions in the industry, HyperWorks includes best-in-class modeling, analysis, visualization and data management solutions for linear, nonlinear, structural optimization, fluid-structure interaction, and multi-body dynamics applications.

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