Hutchinson Breaks New Ground in NVH

LMS NVH Technologies Accelerate Simulations of Rubber-based Solutions

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To strengthen its global leadership in the industrial rubber markets, Hutchinson positions virtual simulation as one of its key differentiators. Extensive and detailed simulations leverage Hutchinson's innovative offering and advance its rubber material research and production processes. Insights from numerical simulations help Hutchinson create successful products that deliver innovative solutions to improve the NVH (Noise, Vibration & Harshness) performance. This together with its system-level focus have made Hutchinson an important NVH engineering partner to players in automotive, aerospace and other manufacturing markets. Simulation and test solutions from LMS assist Hutchinson in achieving its ever-more-complex challenges.

The rubber transformation company

Hutchinson is part of the TotalFinaElf group and is a leading rubber transformation company. Among many other products and systems, it offers fluid-transfer and body-sealing systems, transmission and anti-vibration systems, steering and transmission couplings, mounting systems, body and engine mounts, bushings and belts. Besides its own name, Hutchinson markets other commercial brands, such as Le Joint Français, Barry Controls, Paulstra, Mapa and Vibrachoc. Alliances with other suppliers further extend its business. Hutchinson counts more than 24,000 employees working in over 100 sites worldwide.

The use of rubber generates millions of possibilities in a wide variety of markets. At Hutchinson, both natural and synthetic variants of rubber are engineered, all with different characteristics. These rubber types are also applied as part of rubber compounds and in combination with other kinds of materials, such as metal, glass, plastics, thermoplastics, foams, and composites. Material research is a key differentiator to Hutchinson because it helps the company design less costly materials and increase the productivity of its rubber product lines.

"The LMS systems assist us in understanding the acoustic and vibration performance of engine mounts and vehicle suspension bushings."

Gaining critical engineering information

Engineering rubber parts and assemblies that leverage the performance and cost of the customer's entire system is Hutchinson's main goal. To realize this, the organization accumulated multidomain expertise in order to gain deepened engineering insights and to apply these insights during shortened development cycles. Daniel Benoualid, Director of Hutchinson Group's Corporate Scientific Computing Department, explained, "When it comes to gaining critical engineering insights, systematic use of numerical simulation techniques is key. Best-in-class simulation solutions complemented with in-house developments enable Hutchinson to accurately model solutions in the context of the assembly we are part of. The particularly tough circumstances in which our products operate cause many multiphysics interrelations, which add to the complexity of our assignments. Therefore, virtual prototyping is the only possible way to support us in designing solutions that break new ground in NVH and other multiphysics domains."

Simulating NVH performance

"Accurately predicting the complex NVH behavior of our designs turned out to be very challenging, as our solutions potentially face shocks and repeated movements, transport liquids or gases, become compressed and undergo temperature and pressure changes. We accurately design our systems by setting up very detailed structural models, containing tens or hundreds of thousands of nodes," stated Christophe Barras, Senior Engineer of the Applications team.

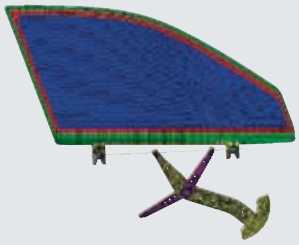
He also commented on the large multiphysics challenges they are confronted with, "We run our own static and dynamic non-linear Finite Element (FE) software, which we successfully coupled with LMS SYSNOISE, the vibro-acoustic simulation tool we use. Such couplings between different software applications enable us to model interacting structural and acoustic effects. Extensive models result in large computational efforts, which we tackle by installing advanced hardware platforms that add up to 200 parallel processors. The splitting up of the job in multiple

Case example

Studying the impact of car door sealings on wind noise

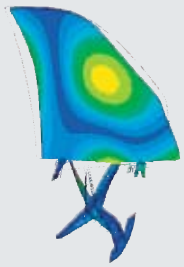
For a leading European car manufacturer, Hutchinson investigated the influence of car window sealings on wind noise. Hutchinson started by determining the exact shape of a sealing on a closed door, using static structural simulations.

To study the combined structural behavior of the glass, its lifting system and the sealing, the team set up a detailed FE model.



Sealed car window with lifting mechanism

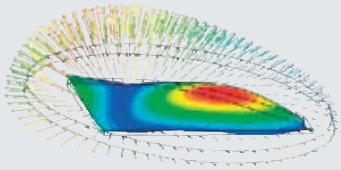
To speed up the modal processing of the 71,000-nodes model, they split it into 16 subdomains, which were processed independently and in parallel by Hutchinson's powerful, multi-processor systems. The modal basis obtained was read into LMS SYSNOISE to enable an accurate prediction of the acoustic performance of the glass and the sealing.



Animated structural mode

The outcome of this ongoing commercial investigation is a better understanding and a more detailed quantification of the impact of sealings on car wind noise.

This offers great opportunities towards the use of thinner, lighter and less expensive window glass, while keeping wind noise within limitations. It also turned out that the glass lifting mechanism significantly influences the acoustic behavior, especially at lower frequencies.



Acoustic intensity distribution

The next step is to test a broader range of different sealings and to extend the simulated frequency range to 3,000 Hertz and beyond.

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domains, which are processed separately and in parallel, reduces the average processing time to a few hours. LMS SYSNOISE is the default vibro-acoustic solution we use for accurate NVH-related performance predictions."

Testing inside-out

Equipped with state-of-the-art anechoic and reverberant facilities and testing equipment, Hutchinson is in good shape to validate its engineering innovations, benchmark candidate solutions and execute tests for research purposes. Various LMS test installations at Hutchinson Research Center include two mobile testing systems (a LMS SCADAS III and a LMS Roadrunner) as well as two workstations with LMS CADA-X software for post-processing such as T-MON, PCA, TPA, FBS, SQ-MON, Modal Analysis, etc. Moreover, parts of this equipment are duplicated in other departments of the Hutchinson group, such as Paulstra. Boris Piquet, Project Manager, explained, "The LMS systems assist us in gaining a deepened understanding of the acoustic and vibration performance of engine mounts and vehicle suspension bushings, for example. Through physical testing, we are able to identify and quantify the impact of Hutchinson's parts on wind, engine and road noise. Once we have traced the exact transfer paths, we focus on the parts that contribute most significantly and alter their designs. Similarly, we are able to test the NVH performance of the mounts and bushings we modified. We also run sound quality measurements to evaluate the subjective human perception of interior noise levels."

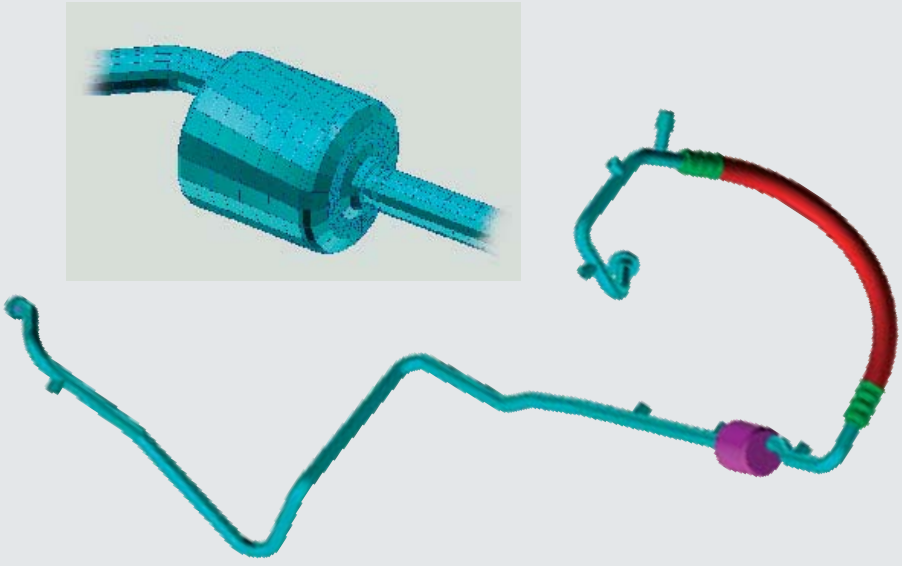
Partnering on NVH engineering

With its multiphysics specialists and their CAE and testing competences, Hutchinson is in the position to literally design on specifications. The staff starts from the detailed requirements and work to pro-actively manage the turnaround towards innovative systems, instead of re-actively designing on price. Daniel Benoualid concluded, "We systematically use knowledge gained from research and commercial projects to create improved raw and compound materials, to better understand their NVH-affecting design parameters, and to enhance the performance of our production lines. These are our differentiators and they inevitably lead to products and systems that are more cost effective and performant in relation to NVH and other critical aspects. Our resolute choice for detailed virtual simulations, large computation power and advanced testing resources helped us to become a well-respected NVH engineering partner. The simulation and testing solutions from LMS have significantly accelerated this important evolution."

Case example

Identifying the participation of an air-conditioning hose in a rattling car noise

Due to the appearance of a highly irritating rattling noise around 800 Hz, a leading French car manufacturer asked Hutchinson and other suppliers to study the detailed acoustic performance of their respective parts. Hutchinson supplied a hose that is part of a leading manufacturer's air-conditioning system. The hose from Hutchinson transports air to an area where it is conditioned to the correct temperature. As the hose connects the chassis assembly (evaporator) and the engine assembly (compressor), part of the hose has been made flexible. Hutchinson started the investigation of the acoustic performance of the hose by building a detailed acoustic model in LMS SYSNOISE. Within the frequency range between 100 and 2,000 Hertz, the team used the 30,000-nodes model to repeatedly simulate the hose's acoustic responses, in steps of 10 Hertz. The "Main fluid flow" feature within LMS SYSNOISE allowed Hutchinson to take the effects of airflow into consideration. The outcome of the study was that Hutchinson was able to prove that the hose did not contribute to the rattling car noise. In addition, Hutchinson simulated alternative hoses with integrated mufflers and demonstrated their superb acoustic performance. The car manufacturer decided to use such a hose type with a muffler because of its outstanding NVH performance, despite its higher price and larger required space.



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LMS is certified to ISO9001:2000 quality standards and operates through a network of subsidiaries and representatives in key locations around the world.

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