

Automotive and transportation

DENSO

Automotive supplier releases products three times faster by using Simcenter Engineering services

Product

Simcenter

Business challenges

Identify source of HVAC noise during product development

Release products in a more timely fashion

Achieve open communication and cooperation with all parties

Keys to success

Develop close cooperation with Simcenter Engineering services

Deploy Simcenter testing methodologies and tools into DENSO's standard HVAC system development process

Determine and resolve noise issues using Simcenter Testlab Transfer Path Analysis

Results

Released products three times faster than previously possible

Reduced time it took to measure TPA by 70 percent

Enhanced collaboration with OEMs

DENSO uses Siemens Digital Industries Software solutions to reduce time needed to make transfer path analysis measurements by 70 percent

Close cooperation enhances results

Automotive air conditioning systems play a large role in passenger comfort. In addition to the functional aspects related to thermal sensation and air quality, the noise and vibration behavior also plays a critical role. Various noise sources, such as the blower, cooling fan, refrigerant flow

and compressor, propagate into the cabin via multiple airborne and structure-borne transfer paths. Identifying the exact source of unwanted heating, ventilation and air conditioning (HVAC) noise during product development is a challenging task.

Assistant Project Manager Tomohiro Sudo of NVH (noise, vibration and harshness) at DENSO, notes, "Every time a new vehicle is developed, a new air conditioning system needs to be integrated. Simcenter Testlab Transfer Path Analysis helps us to quantify noise transfer paths in a shorter time and determine whether a potential problem



“Simcenter Testlab Transfer Path Analysis helps us to quantify noise transfer paths in a shorter time and determine whether a potential problem requires a change on our side or a modification to the body or body integration at the OEM.”

Tomohiro Sudo
Assistant Project Manager
NVH
DENSO

requires a change on our side or a modification to the body or body integration at the OEM (original equipment manufacturer). If we want to deliver a premium end-product, we have to collaborate with all parties involved.”

This kind of open communication and cooperation between suppliers and OEMs is what the Japanese call “suriawase.” The concept of suriawase encompasses integrating a large number of parts to make a high-functioning, complex product. Rather than throwing different parts together, this approach ensures that each part complements the others and adds to optimizing performance. This is realized by maintaining a close association between all parties that are involved in the development process.

This approach has been the key to the success of Japanese companies developing high-end products. DENSO considers Siemens Digital Industries Software an important partner within the suriawase concept.

Speeding the release of products

DENSO and Siemens Digital Industries Software’s Simcenter™ Engineering services started working together in 2007. At that time, DENSO engineers were having difficulty identifying the root cause

of compressor noise in the car cabin. Simcenter Engineering services were the obvious choice to help solve the problem based on a successful track record of helping customers to solve similar issues, and the extensive testing track record and software capabilities of Simcenter Testlab™ software.

That was the beginning of a successful partnership. It started with an engineering services project with a technology transfer, and then continued with deployment of Simcenter testing tools in DENSO’s standard HVAC system development process.

“We do similar projects every year,” says Sudo. “OEMs are really satisfied with the input that we deliver using Simcenter tools. The alternative would be trial and error, which would be very expensive in the development phase. Thanks to Simcenter solutions, we are able to release our new products three times faster than was previously the case.”

Realizing time savings

To identify the compressor forces, typically the inverse matrix method is used. Although this well established method has proven to be successful across many applications, typically significant preparation and testing are required. The compressor has to be physically

“We do similar projects every year. OEMs are really satisfied with the input that we deliver using Simcenter tools. The alternative would be trial and error, which would be very expensive in the development phase.”

Tomohiro Sudo
Assistant Project Manager, NVH
DENSO

Solutions/Services

Simcenter Engineering and Consulting services
siemens.com/simcenter-engineering

Simcenter Testlab
siemens.com/simcentertestlab

Customer's primary business

DENSO is a leading supplier of advanced automotive technology, systems and components for all of the world's major automakers. The company operates in more than 30 countries and regions with approximately 130,000 employees. Global consolidated sales totaled US\$38.1 billion for the fiscal year ended March 31, 2013.
www.globaldenso.com

Customer location

Kariya
Japan

"This new process for transfer path analysis works very well, and allows us to reduce the total measurement time of traditional TPA by 70 percent, mainly thanks to an enormous reduction in the amount of frequency response functions that are measured."

Tomohiro Sudo
Assistant Project Manager
NVH
DENSO

disconnected from the body and a fully populated matrix of transfer functions between the connection locations and the slave locations needs to be measured.

As an alternative process, Simcenter Engineering services proposed a simplified method for the force identification, requiring less preparation and measurement effort. By focusing on the rigid body behavior of the compressor, Simcenter Engineering services proved that all connection forces could easily be deducted from the force in the compressor's center of gravity by a simple geometrical transformation. In this process, the compressor does not need to be separated from the body and only a limited set of transfer functions needs to be measured.

The use of this new testing procedure resulted in a 70-percent time savings without jeopardizing the results. This time gain was a critical argument for DENSO to

justify the resource costs for transfer path analysis (TPA) measurements and postprocessing as part of the standard process.

"This new process for transfer path analysis works very well, and allows us to reduce the total measurement time of traditional TPA by 70 percent, mainly thanks to an enormous reduction in the amount of frequency response functions that are measured," says Sudo.

Thanks to this new, optimized TPA process, DENSO discovered that a potential large noise contribution in a recent project was due to pipe vibration between the compressor and the evaporator. DENSO and the OEM decided to clamp the pipe and the problem was avoided. That is a great example of suriawase between DENSO and an OEM, and Simcenter Engineering services played an essential role in resolving this issue.

"Thanks to Simcenter solutions, we are able to release our new products three times faster than was previously the case."

Tomohiro Sudo
Assistant Project Manager, NVH
DENSO

Siemens Digital Industries Software

Americas +1 314 264 8499
Europe +44 (0) 1276 413200
Asia-Pacific +852 2230 3333

© 2018 Siemens. A list of relevant Siemens trademarks can be found [here](#). Other trademarks belong to their respective owners.
40541-C15 10/18 H

siemens.com/software