DIGITAL INDUSTRIES SOFTWARE

Using Simcenter to predict system NVH performance

Solution brief

Assessing NVH in new vehicle development

Noise, vibration and harshness (NVH) performance assessment is a key focus in new vehicle development. Historically, tests have been carried out on physical prototypes. However, the increase in vehicle variants, advent of electrification and modular platforms and increased importance on controls present new challenges. It is not efficient to build prototypes for every variant, so engineers need new tools to optimize performance with in-depth analysis. Additionally, electric engines are much quieter than traditional internal combustion engines (ICEs), so they do not mask noise sources such as tires or auxiliaries. Therefore, it is difficult to run all necessary NVH tests in a reasonable timeframe and budget.

Creating accurate NVH component models

To meet these challenges, Siemens Digital Industries Software built a system NVH prediction solution. From the beginning, the solution was designed to create a perfect combination of technology and usability. It enables anyone to create a virtual assembly in a modular way to predict NVH performance at any stage of design and development. Each component model can be created based on test and simulation data by using Simcenter™ 3D software, Simcenter Amesim™ software and Simcenter Testlab™ software. These are part of the Xcelerator™

Challenges

- Assess NVH contribution of noise sources including those in electrified vehicles
- Develop a wide variety of vehicles with increased engineering complexity
- Encounter costly or impossible to change NVH issues on physical prototypes
- Assess the impact of vehicle controls on NVH performance early on

Solutions

- Create a component library from test and simulation data
- Virtually assemble system
- Evaluate NVH performance
- Assess alternatives

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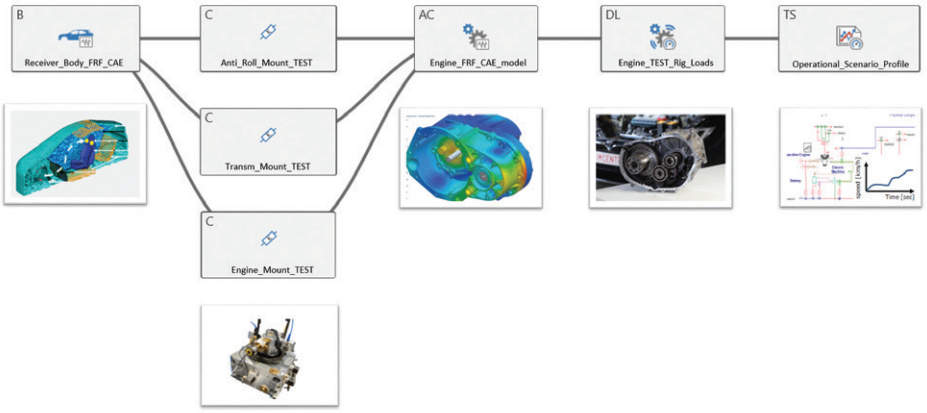
Solution focus



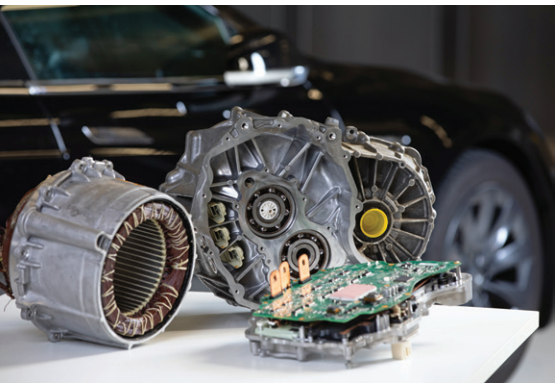
Benefits

- Make accurate predictions
- Choose the best option
- Save time
- Leverage collaboration

portfolio, the comprehensive and integrated portfolio of software and services from Siemens. With test data, the key technology is component-based transfer path analysis (TPA). Unlike traditional TPA, the noise source of the individual components is characterized independently of the final receiver rather than in the assembled product.

Therefore, test and simulation components are created by NVH experts and saved in a standardized format using Simcenter Testlab virtual prototype assembly (VPA) software. The software enables users to create standardized libraries of components that are ready to use in the new assembly.

Test and simulation engineers might use their own naming convention, but this is automatically covered with VPA by using component templates.



Virtually assembling the system in collaboration

Larger organizations discover significant benefits by making the component data available to anyone in the company. Simcenter Testlab VPA supports building a knowledge base to maximize the use of the NVH data produced by an organization and data shared by suppliers. By having this information centrally managed, users can easily search for published component models rather than regularly reinventing the wheel in different areas of the business that do not interact with each other. These modular components can be easily shared between suppliers and integrators, which results in better communication and realistic target setting.

The multiple components are integrated in a virtual vehicle in a modular way using Simcenter Testlab VPA. The user-friendly interface makes the virtual vehicle accessible to everyone, enabling users to perform modification predictions with one click. Substructuring techniques enable engineers to calculate predictions rapidly and accurately by combining the source models with the frequency response function (FRF) assembled system.

System NVH prediction is a scalable solution – it is possible to have a quick source transfer calculation with only a source and receiver component or full-blown models with all sources, subsystems and the receiver body.

Evaluating the NVH performance

Simcenter Testlab VPA is one central application that enables engineers to create a comprehensive digital twin to accurately predict the interior and exterior NVH performance at every stage of the development cycle. Users do not need to be a TPA expert and can accurately predict a variety of NVH performance applications such as booming noise, road noise or pass-by noise and assess NVH for electric and hybrid vehicle operational scenarios. The result is shown in the typical NVH metrics such as contribution analysis.

Analyzing variants

Engineers can easily swap in assembly or design alternatives and immediately see the NVH impact before the vehicle is physically available. For example, they can evaluate the impact of modifying structural properties of the vehicle body, the engine mounts or using different NVH sources such as a new set of tires or a different powertrain. This can all be done without needing NVH experts. System NVH prediction enables manufacturers to deliver excellent NVH performance while keeping development time and cost under control.

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