

APPLY & INNOVATE, TECH-WEEKS

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Place: Online-Concept

**Title: Evaluation of hybrid powertrain control strategy in an NVH Simulator
Experience sound and vibration of a virtual prototype**

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Abstract:

The powertrain control strategy of a hybrid vehicle is a complex system. It depends on driving behavior, state of charge, temperature, drive mode and other variables when it switches from the electric mode to the combustion mode. The design of the energy management system is a challenging task because it affects not only drivability and fuel consumption but also the acoustic performance.

How could engineers perform a proper evaluation of the control strategy especially in early development stages? We propose to combine an NVH Simulator with a powertrain model from IPG CarMaker. The NVH Simulator interactively reproduces powertrain noise as well as wind and tire-road noise. It is based on recordings at the driver's ears. It is also possible to integrate CAE data and test bench data. Using advanced algorithms, the acoustic data is processed in real-time based on the operating state calculated by CarMaker. The driver is in the loop controlling accelerator and brake pedal while he experiences the sound and vibrations of a virtual prototype. In such a simulator engineers from all departments involved can tune the energy management system to find the best compromise for acoustics, drivability and fuel consumption. Another aspect is a continuously variable transmission (CVT). The rpm and therewith the engine sound are not in a fixed relation to speed but variable. Different strategies can be compared in a simulator under safe and reproducible conditions. A driving simulator is particularly suitable for the evaluation of complex systems that involve a lot of human interaction.