

## **DAGA 2020**

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**Place:**

Hannover, Germany

**Title:**

**HiL and SiL approach for Active Sound Design in a NVH Simulator**

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**Abstract:**

In electric or hybrid vehicles interior Active Sound Design (iASD) sets emotions or gives acoustic feedback that the physical engine sound might not offer. Engine Sound Enhancement (ESE) masks cylinder deactivation or makes the sound of downsized combustion engines more powerful.

In a software-in-the-loop (SiL) or hardware-in-the-loop (HiL) approach the sound generating device can already be tuned in a NVH simulator considering the actual driving sound. The NVH simulator is an interactive playback of wind noise, tire-road noise and physical engine sound. The driver closes the loop by listening to the sound and controlling the throttle and brake pedals.

The benefit of the HiL approach is that the hardware platform of the vehicle is used in a very early development phase. The sound designer can work as early as possible with the target platform to achieve a faster workflow without compromises from the design phase to the production phase. The SiL approach enables the use of established tools for sound creation building the bridge between creative musicians and engineers.

The proposed approach speeds up the process because the sound is perceived according to the driving dynamics and the masking noise is already considered in a prototype phase. The real vehicle is only needed for a final tuning.