NVH Simulator Provides Realistic Driving Experiences

The people behind the organization previously known as NoViSim, Roger Williams, Mark Allman-Ward, Thorsten Heinz and Andreas Brückmann have joined Brüel & Kjær as of August 1, 2012.

Brüel & Kjær has been the exclusive sales channel for the NVH simulators from NoViSim since 2005, later adding SoNoScout and SPC Time Insight to the portfolio. The NoViSim team has worked closely with the B&K automotive team to develop the products, which have received a very positive reception from customers. A significant number of automotive OEMs have understood the unique benefits that the NVH simulator product portfolio offers and have purchased licenses for their vehicle development programs, often for multiple seats.

The NVH Simulator has been under continuous development for more than 10 years in close collaboration with vehicle manufacturers and suppliers, to ensure that it fits the automotive market's need for faster, lower-risk development by assisting better decisions on specs (targets) early in the concept stage, efficient engineering during development, and final sign-off with high confidence of success. The result is a suite of solutions that provides real improvements in both the speed and the quality of the NVH decisions taken. The NVH Simulator is available as four solution families:

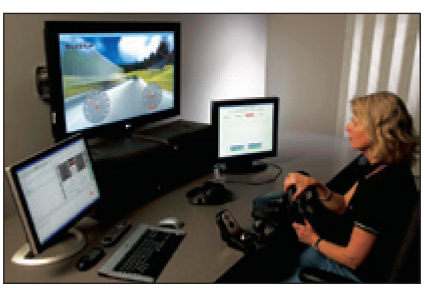
Desktop Simulator. Intended for use as an evaluation and development tool, the Desktop Simulator provides in-context evaluation of sound contributions from the total vehicle down to individual components. The contributions can be switched or modified in real-time while driving in a realistic situation with pedals and a steering wheel.

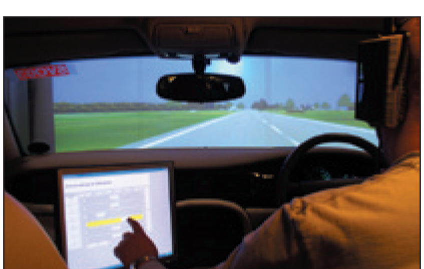
Full-Vehicle Simulator. Contains the desktop simulator in a donor vehicle and allows the addition of driver-sensitivity point vibration control for an increased immersive experience.

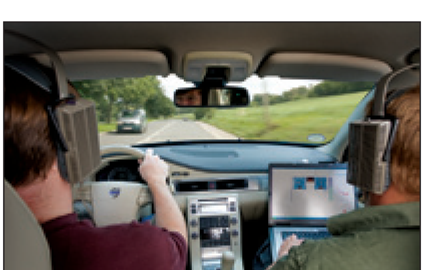
On-Road Simulator. Uses a vehicle bus system to provide real-time sound simulation of any vehicle while driving on the road using sound cancellation techniques.

Exterior Sound Simulator. Allows the assessment of traffic noise as a pedestrian in urban environments. This is of particular interest in developing electric and hybrid-electric vehicles where the noise profile is often too quiet to give warning of approach and can represent a hazard, especially to sight-impaired people.

The team will continue to develop and enhance these products and will work alongside other development teams at B&K on new product programs and closer integration with the PULSE Reflex environment.







For additional information on NoViSim and other Brüel & Kjær products, please visit: www.bksv.com.

Airborne TPA Using Microflown Technologies

Andrea Grosso, Microflown Technologies, Arnhem, the Netherlands

The understanding of noise generating mechanisms and sound propagation is nowadays one important step in the development process of any modern manufacturing environment. Sound source localization techniques have been developed over the years to reduce time and cost for development to achieve noise reduction and sound quality. In particular, car interior noise has been widely investigated. In addition to classical pressure based measurements, novel techniques have been studied, like near field holography, beamforming and inverse methods (substitution monopole techniques).

Typically the interior noise of a car is perceived as a quality index for automobile manufacturers. One well-known method for sound source ranking is transfer path analysis (TPA). General TPA can be divided into structureborne TPA and airborne TPA. Both methods play an important role in the development process and refinement of automobile interior noise, and they are attractive from a technical and practical point of view.

Airborne TPA is the main focus of two products from Microflown Technologies – Scan&Paint TPA and PNCAR. Both systems are based on direct measurement of particle velocity; only the techniques are different.

Direct measurement of particle velocity has enabled airborne transfer path analysis to become more efficient and less time consuming. There is no need to apply absorbing materials to the surfaces to be measured, and the measurements can be done under driving conditions. There is also no need to apply complex mathematics. Wide dynamic range simplifies locating and ranking of both dominant and non-dominant sources.

A Scan&Paint TPA measurement is divided into two steps. The first step is similar to a standard Scan&Paint measurement and should be done under operating conditions with the car running on a test bench or on the road. The surface is scanned with one PU-probe while cameras are focused on the surface being scanned. Measurement positions of the probe are extracted and tracked in color from the video. A microphone is placed at a reference position to keep phase correlation of different surface velocities.

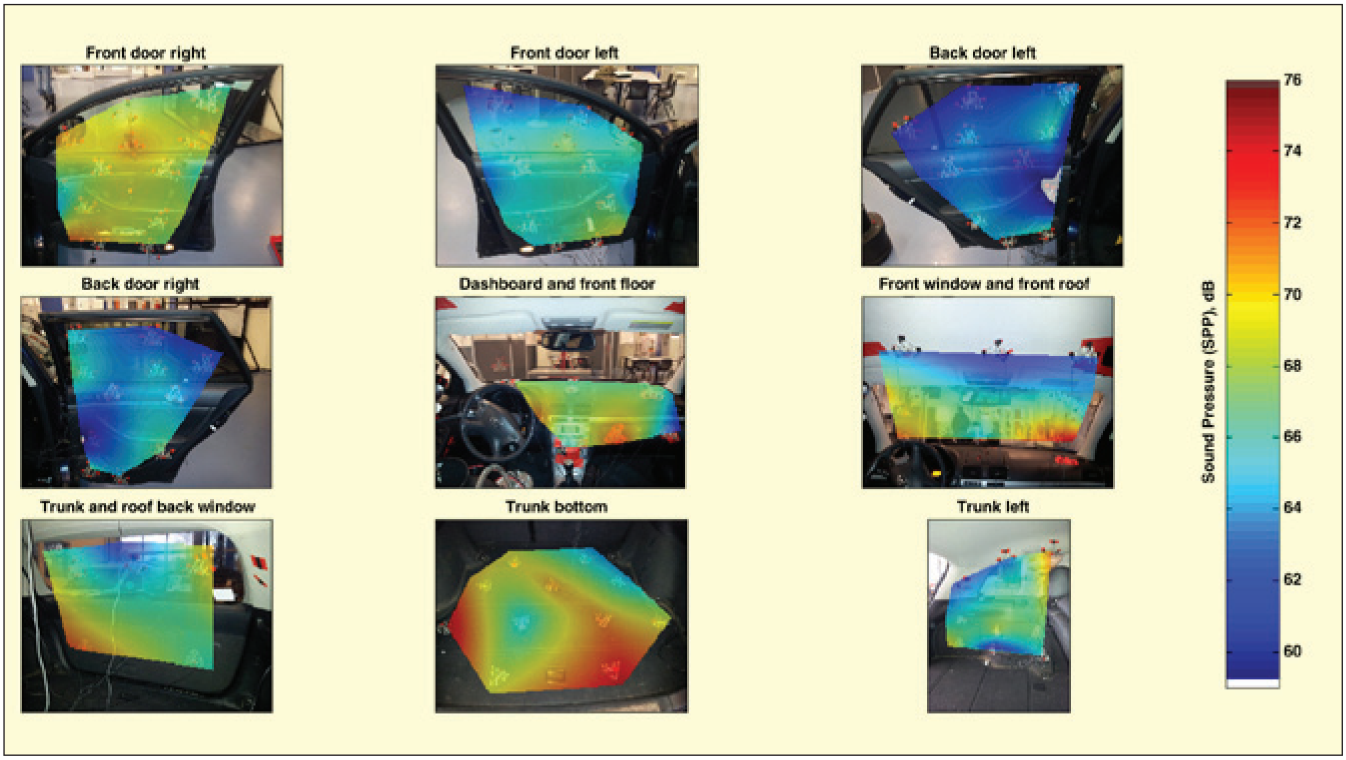
The second step consists of measuring the transfer functions from the surface to the reference position when the car is not running. This means a monopole sound source is positioned at the listener position (the driver's ear location for example), and sound pressures are measured over the surface using the same scanning method. The cross spectra between particle velocity at the surface and the pressure at the reference position are calculated and contain the relative phase information between the different measurement points.

A PNCAR measurement technique is much different. Scan&Paint TPA requires only one probe. PNCAR uses multiple probes in special mountings spread over the interior surfaces. The mountings are used to decouple the probes from the surfaces. This allows the full car interior to be measured with a limited number of probes. Postprocessing consists of matching together all the sessions using a reference signal. As in Scan&Paint TPA, an additional reference microphone is needed. A multiple-probe solution allows measurement of transient noise conditions, like an engine run-up for example. RPM tracking enables order analysis and other related processing techniques.

Depending on measurement requirements, one of these two solutions will provide fast and qualitative airborne transfer path analyses.

Scan&Paint TPA Features

- Frequency range: 60 Hz-7 kHz
- Velocity dynamic range of over 40 dB
- Measurement of particle velocity and sound intensity at the surface
- Pressure contribution
- Phase mapping
- Transfer path



PNCAR airborne transfer path analyses of various surfaces within an automobile body: frequency range – 355-710 Hz; sound pressure range – 60-76 dB.

- No need to apply absorbing materials
- High spatial resolution
- Suitable for stationary conditions
- One-day measurement for entire car interior

PNCAR Features

- Frequency range: 40 Hz-2 kHz
- Velocity dynamic range of over 40 dB
- Measurement of particle velocity and sound intensity at the surface
- Pressure contribution
- Phase mapping
- Transfer path
- No need to apply absorbing materials
- Suitable for non-stationary conditions
- One-day measurement for the entire car interior

For additional information on these applications and Microflown products, please visit: www.microflown.com.