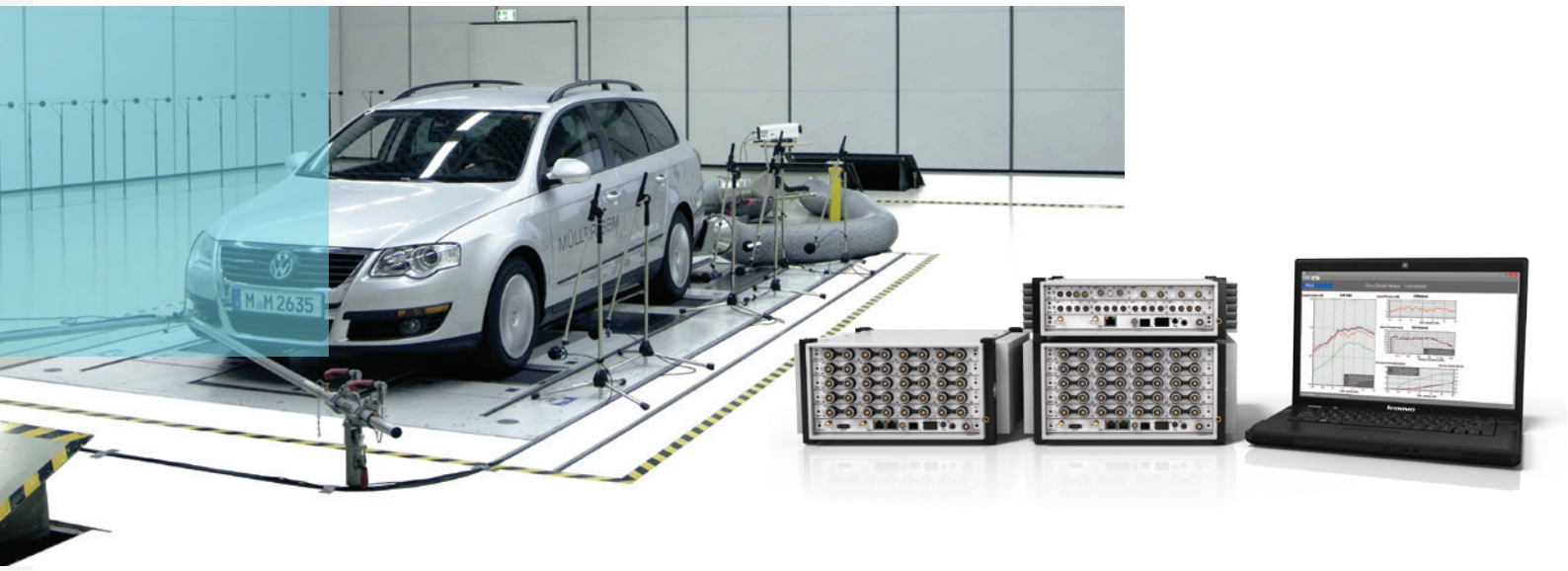
MÜLLER-BBM
VibroAkustik Systeme

PAK

SIMULATED PASS BY MEASUREMENTS

Besides real Pass By measurement, the ability to determine the vehicle's entire exterior noise based on simulated Pass By measurements and tire roll noise simulations has become more prevalent. One of the advantages of this method is the weather-independent availability of the test bench which allows for the continuous execution of test cycles.

As such, simulated Pass By measurements have become an important solution for achieving development objectives in the development and engineering process by focusing on the design or reduction of external acoustic noise and subjective perception.



THROUGH **CONSTANT MEASUREMENT CONDITIONS** IN A TEST BENCH, A **BETTER COMPARISON** OF VEHICLE **MODIFICATIONS** IS ACHIEVED.

Simulated Pass By in the level domain

Simulated Pass By provides a simulation of the “emitted noise from an accelerated vehicle” (UN ECE 51.02 and UN ECE 51.03 R). In doing so, the sound pressure level is acquired by 2 opposite microphones. The simulation is based on the sound pressure level of the stationary vehicle acquired from 2 neighboring microphones.

The individual microphone signals are only exact at a discrete time or distance. Between this, interpolation automatically takes place. Through distance correction, the signals are adjusted if the corresponding microphone is placed too close or too far.

WE WOULD BE PLEASED TO DEMONSTRATE THIS APPLICATION. Come and take a ride with us.

Simulated Pass By in the time domain (TIPS)

In time-based Pass By simulation raw time data from a simulated Pass By measurement is converted into a data set that corresponds to a “real” Pass By measurement. Besides the determination of third octave and detector analyses at both the “left” and “right” microphone positions, the time signals at the “left” and “right” positions are also determined. These time signals correspond to the quasi-stationary microphone signals of passing vehicles. Thus, the raw time data can be played back and analyzed in both the time and spectral domain.

Due to different run-times between the vehicle reference point and the Pass By microphones, the application automatically calculates the run-times from the geometry and sound speed. Following this, the signals are synchronized.

For a more realistic perception - especially at constant speeds - the Doppler effect can be taken into account from the distance and speed information.

Correction of tire roll noise

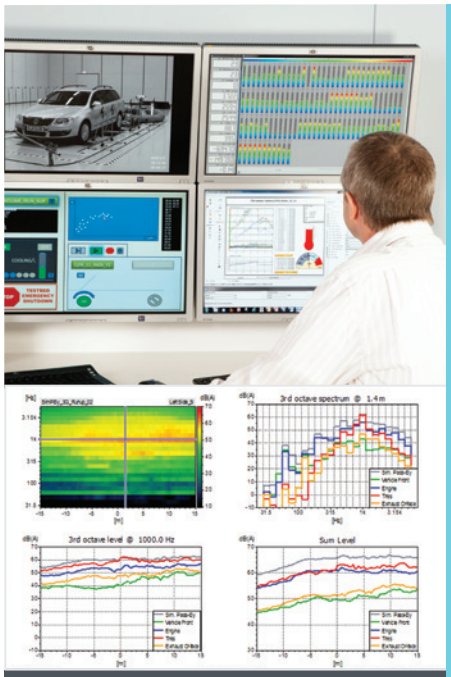
Besides drivetrain noise, tire/track noise is an essential source of the vehicle’s exterior noise. Due to the increased targeting of eligibility criteria on urban driving, the tire/track noise is weighted more significantly.

The known problem of tire noise on the caster is taken into account through the acquisition of both the signature of a tire on the caster and of a tire on the real test track surface. These signatures are incorporated into the simulation – especially the roll contribution.

The total tire roll noise of a vehicle can also be separated into roll noise and load noise. This allows for a quick, “virtual” tire change on the test bench when requiring different tires.

Execution is as follows:

- Analysis and simulation of the roll contribution (torque-free rolling tire),
- Analysis and simulation of the load contribution (transfer of drive torque to the tires) and
- Synthesis to predict the tire/track noise across different driving dynamics. The synthesis of the tire/track noise to a given driving profile at the measurement track from roll and load contribution is accomplished by a simple level addition.



Contribution analysis

The traditional method to analyze the composition of the exterior noise is the ‘Masking Method’. In this method, single sources are acoustically encapsulated so that they can no longer contribute to the overall sound. From the level difference (with/without masking), deductions regarding the actual contribution of the source can be made. Unfortunately, this method is very time-consuming.

PAK Contribution Analysis separates individual components of exterior noise through transfer path analysis (TPA). As such, the main sources are acquired by local sensors (microphones) during a simulated Pass By measurement. The relative contribution of the sources are then determined through an Operational TPA for each component at each microphone position. This results in several (simulated) Pass By measurements – each representing only the contribution of a source.

The acquisition of additional noise related data enables a source-related representation of the dependencies between source and the respective contribution. The characteristic sounds of single components are considered in the causal loop.

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