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Vehicle NVH Development
Sound Design with VINS

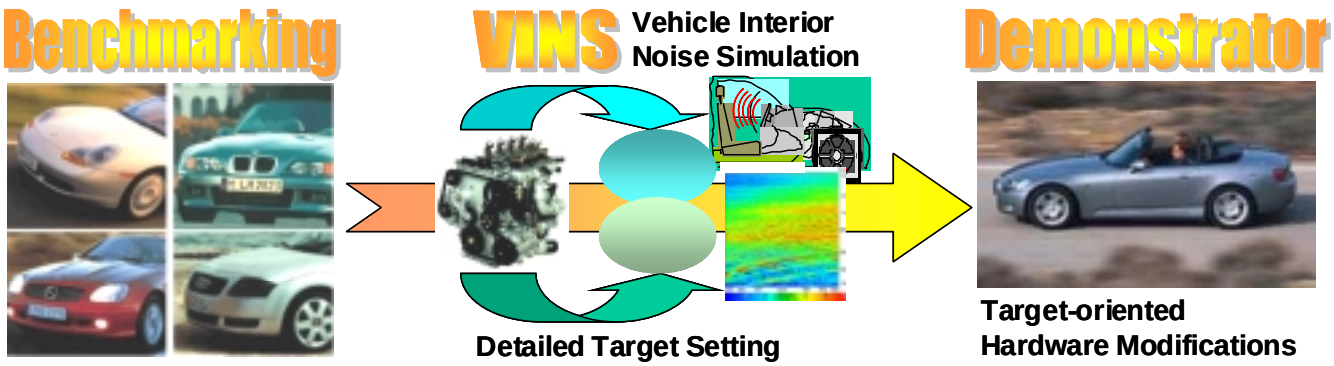
*Vehicle interior noise is an important factor in conveying overall vehicle quality to the driver and potential customer, thus having considerable influence on their purchasing decisions. In response to this fact, FEV has developed a systematic interior noise optimization procedure centered around customer expectations and a satisfying driving experience. The main tool used in this procedure is FEV-**VINS**: **V**ehicle **I**nterior **N**oise **S**imulation.*

The sound design procedure starts with a **benchmark** of the prototype and competitor vehicles. The characteristic parameters of vehicle interior noise, noise sources and transfer paths are presented in vehicle class dependent scatterbands which are based on measurements of more than 300 vehicles.

In a **rough target setting,** the unpleasant as well as missing noise shares are characterized according to driving conditions, frequency range and engine order content.

Sound Design Process with VINS

- **Benchmarking**
  - Database of 350 vehicles
- **Rough Target Setting**
  - Definition of unpleasant and wanted noise shares
- **VINS: Vehicle Interior Noise Simulation**
  - Association of each noise share with its sources and paths
- **Detailed Target Setting Based on VINS**
  - Virtual Sound Design by realistic noise source and path modifications
- **Demonstrator Vehicle**
  - Target-oriented hardware modifications



Subsequently, the vehicle interior noise is analyzed in detail with FEV's unique tool **VINS**. With VINS, the interior noise is broken down to the contributing powertrain related noise sources and corresponding transfer paths. Airborne noise sources (such as engine noise, intake and exhaust system noise) as well as structure borne noise sources (such as powertrain mounts and differential suspension) are considered.

Based on VINS, a virtual sound design is created through realistic noise source and noise path modifications. This is used for a **detailed target setting** of the overall interior noise optimization. The targets for the individual noise sources and transfer paths can then be deduced.

The virtual modifications in the target setting process are related to individual vehicle components, leading to target-oriented hardware modifications. VINS can be combined with other CAE-methods, e.g. CFD calculations of the intake system orifice noise, resulting in an audible optimized interior noise without the need for costly and time consuming hardware modifications. Finally, a **demonstrator vehicle** featuring the target sound can be built by combining the selected hardware modifications.

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