

Powertrain NVH Development Diesel NVH Noise Refinement

Diesel Truck NVH Development

Aside from "classical" requirements concerning further reduction in fuel consumption and exhaust emissions of heavy-duty diesel trucks, NVH aspects have become more and more the focus of attention. In 1989, the night driving ban in Austria for trucks exceeding the 80 dBA limit required by the ISO Standard R362 drive-by test gave an additional impetus to NVH improvement of heavy-duty diesel trucks

Transient noise of diesel engines can exceed steady-state full load noise by up to 6 dBA. The significant combustion noise increase due to increases in ignition delay is considered to be the main cause for transient diesel engine noise.

Current engine noise optimization is typically based on steady-state engine measurements, as transient dynamometer acoustic test cells are rare. Yet, according to current noise legislation, the vehicle drive-by test requires transient engine operation, since transient noise of DI diesel engines exceeds steady-state noise significantly. Therefore, the knowledge of NVH relevant differences between both engine-operating conditions is a prerequisite for effective noise improvement.

Simulation of Drive-by-Test in Acoustic Test Cell

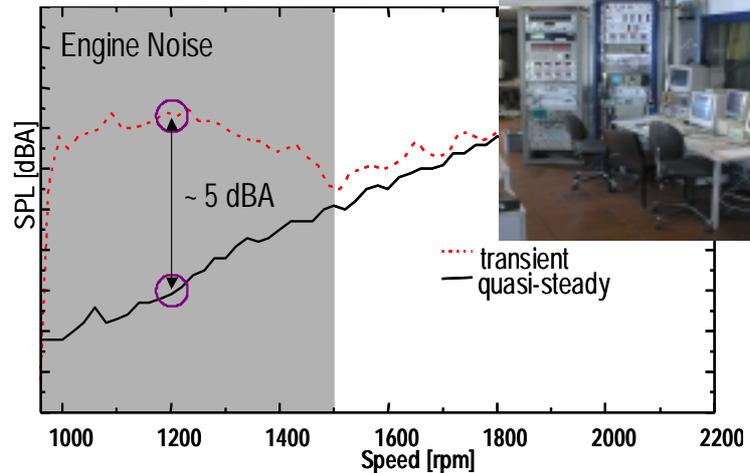
FEV has developed a technique to simulate the transient NVH performance of an accelerating vehicle during the drive-by test. The complete powertrain using appropriate transmission gear ratio and eddy-current brake inertia is utilized during these test.

To ensure repeatable testing, FEV utilizes a specialized control system developed for these unique operating conditions.

Multi-channel data acquisition recording of all transient condition relevant engine and NVH parameters at very high sampling rates is utilized to capture the complete transient behavior.

Transient Noise Optimization

Through use of this simulation technique the transient noise of the diesel engine can be improved. Besides structure optimization and encapsulation, optimization must aim



at reducing the ignition delay by:

- Optimizing the injection timing
- Injection rate optimization
- Increases in boost pressure
- Exhaust gas re-circulation

Transient tests have to be implemented in the powertrain NVH development process as prerequisite for excellent product quality during all driving conditions. The simultaneous development in a combined NVH/Thermodynamic powertrain test cell is prerequisite to find the most favorable compromise between excellent vehicle acceleration performance and acceptable transient noise and emission behavior.

CONTACT: Dr.-Ing. Norbert Alt
FEV Motorentechnik
Neuenhofstrasse 181
52078 Aachen, Germany
Phone: +49 (0)241 5689-419
Fax: +49 (0)241 5689-119
E-Mail: alt@fev.de
Internet: <http://www.fev.com>