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# End-of-line quality testing

Robust and reliable EOL testing during manufacturing adds value to a product by confirming the quality – meaning that the part meets its specifications

The construction of every vehicle requires assembly of countless parts, produced by suppliers with different standards. Consequently, in each production line it is key to maintain a high level of manufacturing quality to prevent extra costs related to rework, product recall, or the loss of stakeholder and customer trust.

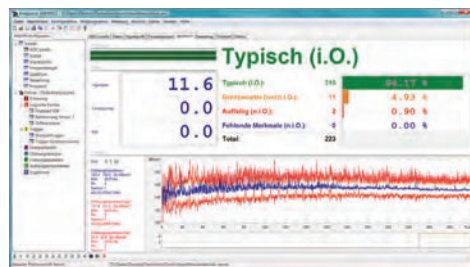
To ensure vehicle quality, the performance of essential components in the modern powertrain – such as the ICE, transmission and electric motors – must be validated via end-of-line (EOL) testing using advanced methods, and vibration and sound analysis.

In an electric car, the NVH performance requirements differ from those in traditional ICE cars. As the electrical engine operates at a lower sound level, and noises that were originally masked are revealed, any imperfection on the engine or transmission is much more audible. Therefore, in the assembly of EVs, EOL testing requirements and standards are also different.

Spotting this need, Siemens extended its Simcenter portfolio with a robust and reliable industrial quality testing system – Simcenter Anovis – which can be easily integrated into EOL test benches and production lines. This system helps to ensure product quality at a lower production cost, while preventing outages and reliably identifying defects. Moreover, Simcenter Anovis



Transmission analysis on the production line. Siemens software can be adapted to a broad range of auto applications



Signal analysis in the Simcenter Anovis environment

is designed to provide valuable insights for further product advances by indicating the possible root cause of issues. It facilitates streamlined data transfer between manufacturing and research and development teams.

The new Simcenter Anovis system compiles data from all the required sensors, registering large bandwidths, including vibration (via accelerometers or laser vibrometers), sound (via microphones), rotational speed (via high-precision tachometers), temperature and torque. These sensors are coupled with accurate sound and vibration signal recording hardware.

In seamless conjunction with the test bench control systems, Simcenter Anovis software provides smart signal analysis to precisely perform pass/fail checks. The software

enables users to analyze recorded signals based on smart methods operating in frequency, order, angle and time domain, and reliably detects relevant fault patterns. Statistical assessment procedures dynamically tune thresholds and turn the platform into a self-learning system, reducing setup effort and the required expertise. As a result, the responsible team can deliver a report confirming the quality of the part.

The Simcenter Anovis system has a high process speed. The innovative sound and vibration-based fault detection algorithms, in combination with automatic limit adaptations and classic NVH measurements, enable the Simcenter Anovis system to detect product or process imperfections within seconds.

Simcenter Anovis covers EOL testing and early damage

detection using vibration and sound measurements for most of the automotive powertrain and steering components. Diesel and gasoline engines can both be examined with the automated cold and hot testing methodology. Electric motors are inspected for quality through automated checks during the production of the electric drives and servomotors. Turbochargers also undergo quality checks by order analysis at a high-revolution speed.

Simcenter Anovis can be used for EOL testing for all types of transmissions – automatic, continuously variable and manual.

In addition to the core applications related to the powertrain, this EOL testing system, using the same methodology, can be applied to electric motors for small components. Although vehicle interiors are generally becoming quieter, acoustic testing of these components is growing in relevance. This also applies to parts such as modules for motorized drive mechanisms such as air-conditioning units, seat structures and beyond.

Simcenter Anovis embodies decades of expertise in automated, proven NVH test procedures, providing OEMs with precise testing solutions requiring minimal time. Globally supported, Simcenter Anovis facilitates continuous process improvement by providing valuable insights for developing product and production digital twins. <



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