HOW NVH ELEVATES ‘FUN TO DRIVE’ QUOTIENT

The significance of Noise, Vibration and Harshness (NVH) has grown with the evolution of mobility, cost efficiency focus and customer comfort. Cost of ownership, longer driving distances, noise reduction regulations, digital travellers on the move, and comfort and convenience have accelerated the thrust on NVH management. NVH management is required across systems inside the cabin, under the hood, pass by noise that includes exhaust and road noise transmitted through the underbody and tyres.

NVH engineering is an integrated medium of innovative materials, fluids, electronics, embedded controls, and virtual engineering analyses combined with physical testing. The three aspects of N, V and H are inter-related and strongly influence each other. The refinement of NVH results in longevity of systems, fewer heat dissipating mechanisms, reduction in interfacing complexity, and enhanced reliability of vehicle systems and components.

STARTING EARLY

NVH engineering and management has to begin early in design and development and during vehicle systems packaging layouts, followed by manufacturing. The design, development and fabrication of Body in White (BIW), for example, has to be optimised early to ensure plugging of holes and gaps in the firewall that separates the under hood and cabin. The packaging of voids in the A, B and D pillars and the hood design needs noise isolation in the early stages. The trunk has to be isolated similarly along with the underbody. The styling and shape of the vehicle determines NVH inside the cabin, besides other benefits of cost and performance.

Vibrations in various systems can reduce life and reliability, increase cost and be irritants to the driver and occupants. The fun to drive experience could vary depending on powertrain dynamics, vehicle tuning and torque transmission to the wheels. This attribute, likewise, has to be reviewed and mitigated at the initial design and development stage. The bending and dynamic loads in the engine and transmission assembly, the mounting and assembly of manifolds, exhaust system design, the powertrain mounts and several components have to be interfaced optimally with other vehicle systems. The mission of NVH engineers is to conduct analyses of loads, bending frequencies, and resonances to be mitigated in the vehicles. Post analyses, recommended mitigating measures are to be deployed with an alignment with vehicle design specifications and integration.

Harshness in sub-systems interface, seating systems, high speed driving and vehicle idling can degrade life because of friction and heat dissipation challenges, besides being an intrinsic irritant. This too reduces life of sub-systems and increases cost. Complaints of harshness in clutch and transmission interface, stiffness in steering, noisy FEAD (Front End Accessory Drive) belts, squeaking brakes and door hinges, vibrating pedals and rough gear shifting are limitations in a fun driving experience and systems’ life.

MANAGING NVH

NVH management can be active and passive, specific to the application, priorities and cost. Active techniques deploy interfaces with electronic controllers in the vehicle systems via intelligence and memory embedded in control architectures. Active systems vary the stiffness properties of materials electrically through capacitance depending on vehicle parameters. Materials play a key role in the foundational philosophy of NVH mitigation. Optimised deployment of materials is necessary to avoid negative weight effect, improve packaging and heat dissipation since they impact fuel economy. The advent of lightweight metal matrix composites, structural foam materials, self-shaping memory alloys, magnetic and nano fluids, honeycombs, plastics and rubbers have augmented innovative NVH-friendly solutions in mobility.

The direct and indirect impact on cost of ownership, driving experience and sustainable mobility is dependent on the ability to understand and mitigate NVH. The utilisation of appropriate techniques and processes with tangible actions undeniably results in a fun to drive experience.

Read this article on www.autotechreview.com