

The Dynamics of Noise and Vibration Engineering Vibrant as ever, for years to come

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ABSTRACT

Over the past 20 years, constant progress in noise and vibration (NVH) engineering has enabled to constantly advance quality and comfort of operation and use of really any products - from automobiles to aircraft, to all kinds of industrial vehicles and machines - , to the extend that for many products, supreme NVH performance has becomes part of its brand image in the market. At the same time, the product innovation agenda in the automotive, aircraft and really many other industries, has been extended very much in recent years by meeting ever more strict environmental regulations. Like in the automotive industry, the drive towards meeting emission and CO2 targets leads to very much accelerated adoption of new powertrain concepts (downsizing of ICE, hybrid-electrical...), and to new vehicle architectures and the application of new materials to reduce weight, which bring new challenges for not only maintaining but further improving NVH performance. This drives for innovation in NVH engineering, so as to succeed in meeting a product brand performance for NVH, while as the same time satisfying eco-constraints. Product innovation has also become increasingly dependent on the adoption of electronics and software, which drives for new solutions for NVH engineering that can be applied for NVH performance optimization of mechatronic products. Finally, relentless pressure to shorten time to market while maintaining overall product quality and reliability, mandates that the practice and solutions for NVH engineering can be optimally applied in all phases of product development. The presentation will first review the afore trends for product and process innovation, and discuss the challenges they represent for NVH engineering. Next, the presentation discusses new solutions for NVH engineering of products, so as to meet target brand values, while at the same time meeting ever more strict eco constraints, and this within a context of increasing adoption of electronics and controls to drive product innovation. NVH being very much defined by system level performance, these solutions implement the approach of “Model Based System Engineering” to increase the impact of system level analysis for NVH in all phases of product development:

- At the Concept Phase, to be able to do business case analysis of new product concepts; to arrive at an optimized and robust product architecture (e.g. to hybrid powertrain lay-out, to optimize fuel economy); to enable target cascading, to subsystem and component level.
- In Development Phase, to increase realism and productivity of simulation, so as to frontload virtual validation of components and subsystems and to further reduce reliance on physical testing.
- During the final System Testing Phase, to enable subsystem testing by a combination of physical testing and simulation: using simulation models to simulate the final integration context when testing a subsystem, enabling to frontload subsystem testing before final system integration is possible.
- To interconnect Mechanical, Electronical and Controls engineering, in all phases of development, by supporting model driven controls engineering (MIL, SIL, HIL).

Finally, the presentation reviews examples of how LMS is implementing such new applications for NVH engineering with lead customers in Europe, Asia and US, with demonstrated benefits both in terms of shortening development cycles, and/or enabling a simulation based approach to reduce reliance on physical testing.