LMS Engineering services
Multi-attribute optimization using body concept models

Driving design decisions by analyzing road noise and vehicle handling performance

Benefits
• Gain insight into the underlying mechanisms and interactions between road noise and vehicle handling performance
• Understand the relation between local and global dynamic stiffness
• Provide directions for body design improvement
• Guide body design by driving dynamics and NVH requirements
• Implement a process that frontloads design decisions

Summary
LMS™ Engineering services help you implement a process that frontloads design decisions by analyzing the mechanisms behind road noise, enabling you to understand the relationship between road noise and vehicle handling performance on body concept models.

Vehicle handling is one of the most defining qualities of a car, and a good design can result in enjoyable ride comfort and low road noise levels. Finding the right balance between those often conflicting functional performance characteristics is a challenging engineering task when designing next-generation lightweight vehicles. Fast body concept assessment provides the necessary insight into road noise and vehicle handling performance that allows you to give design engineers precise directions.

This approach endorses frontloading design decisions, ultimately saving cost and reducing time-to-market.

Fast body concept assessment typically begins by reducing an existing finite element body model of a similar vehicle to two efficient-running concept models: one for noise, vibration and harshness (NVH) and the other for vehicle handling calculations. Both simulations are performed in parallel, and help you understand the relation between global and local stiffness and the forces between body and chassis, as well as their influence on the attribute targets. Combining both results, engineers can propose conceptual modifications to the body in order to iteratively improve the overall design.

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A typical fast body concept assessment project is comprised of the following phases:

Road noise analysis
LMS Engineering experts describe components by frequency response functions (FRFs) and build FRF-based substructuring (FBS) models. They use these models to calculate the full vehicle vibro-acoustic response to an invariant force on the wheel knuckles, and all the connection forces between body and chassis, strongly focusing on the lower frequencies. FBS allows cascaded contribution analysis, providing valuable insight into the relation between input, connection forces, local and global stiffness and subsequent responses. These accurate and efficient calculations are especially suitable for conducting what-if analysis. The effect of changing mount stiffness or body FRFs can be evaluated within minutes.

Vehicle handling analysis
By including flexible body modes in multi-body simulations, LMS Engineering experts can visualize the body deformation during maneuvering and relate the body behavior to handling parameters (such as yaw rate or roll angle). These calculations reveal which forces excite the body for each time step, which body modes contribute and the relative importance of local versus global body stiffness for the connection point deformation, enabling studies on the impact of body modifications. This combined information allows a weak-point analysis to evaluate and set body targets for improved vehicle handling performance.

Body concept modifications
LMS Engineering experts investigate modifications that improve the overall performance. Beam concept modeling and advanced model reduction technology can help you study many modifications and their effect on global vehicle behavior in short order.