

Practical Structural Dynamics Modification for Vehicles

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For the practical way to perform the Structural Dynamics Modification (SDM) beyond the Experimental Modal Analysis (EMA), the key technologies are the Real Mode Parameter Estimation (RMPE), the Rigid Body Mode Enhancement (RBME), and the Rigid Body inertia Property calculation by using a Geometry data (RBPG). This paper shows the advantages of these technologies by applying them to an example car body in white and an example pickup truck.

The modal model of the car body in white is a hybrid model that is combined 6 analytical rigid body modes by using the RBPG and 12 flexible modes by using the RMPE. The reason was that the car body was testing while resting on the air mounts to approximate free-free boundary conditions.

The Fig.1 shows the reinforcement of the car body in white at the trunk room.

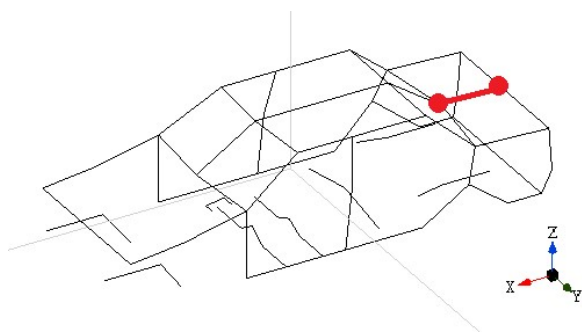


Fig. 1. Reinforcement of the car body in white at the trunk room

Fig.2 shows the effect of the reinforcement at FRF(44X/1Z) of the pure free-free car body in white.

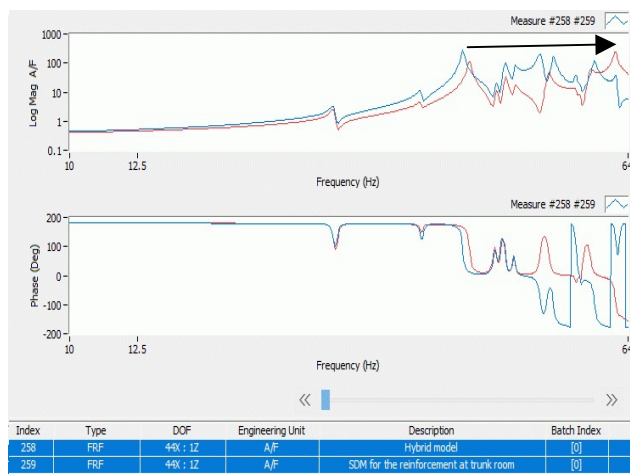


Fig. 2. Effect of reinforcement at FRF(44X/1Z) of the car body

The pickup truck was testing on real suspensions and tires to the ground so that the modal model was obtained only by using EMA.

The RMPE was used to extract all of 27 modes but the lower 6 modes were updated to pure rigid body modes by using the RBME.

The Fig.3 shows the reinforcement of the pickup truck to tune up the torsional mode and bending mode of the body to certain frequencies.

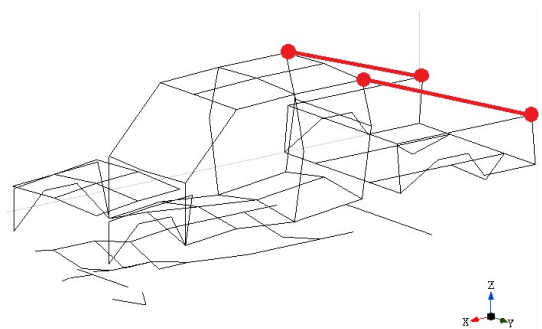


Fig. 3. Reinforcement between cabin and bed of the pickup truck

Fig.4 shows the effect of the reinforcement at FRF(109Z/135Z) of the pickup truck on its suspensions and tires to the ground..

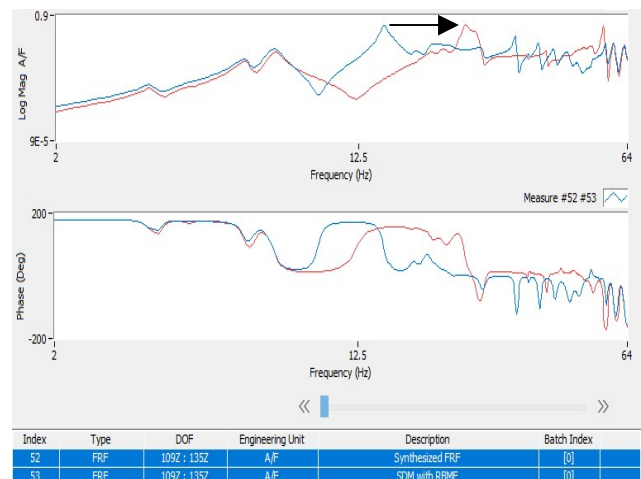


Fig. 4. Effect of reinforcement at FRF(109Z/135Z) of the truck