"Optimization of Noise and Vibration of a Car Roof using Damper by Experimental Method and Validating by FEA Method"

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Abstract— The degree of the endeavor is to remark on the present cases and new movement in the field of exploratory particular examination. To diminish the vibration to a limited extent there are two strategies in the examination to be particular measured examination through FE technique and trial secluded examination. To do the FE procedure the portion is made using programming called CATIA V5R20. By then this is removed by HYPERMESH programming for cross area the part. ABAQUS solver comprehends the cross segment part, FE system is done by free - free procedure gets the unmistakable frequencies or mode shapes at different centers. The examination is done in two courses, with Damper and without Damper; the Damper is used to reduce the vibration of the part. The solver is used to get the basic repeat. To take a gander at the measured examination result we are doing trial examination. It is finished using one of a kind part to get customary repeat or mode shapes at different center points and it is done only for nothing - free methodology.

Keywords – Damper, FEA, Mode shapes, QUATTRO

I. INTRODUCTION

Since the good 'old days we are knowledgeable about the vibration issues in the various fields. This vibration issues are from step by step human use sections to the bigger sum building issues. Regardless, we haven't given much essentialness till couple of decades back. In a matter of seconds a day's vibration issues are considered as one of the main problems in science and development. Auto history date backs to seventeenth century. The whole history of auto can be divided into number of times [1]. This is confined on the reason of drive, at the edge on the examples, for instance, style, jazzy, utility thus on expected a fundamental part.Nicolas Joseph Cugnot in 1768 was the primary individual to create an auto. Which is steam energized and after that the up degree in design, engine happened and it is continuing till date.

II. LITERATURE REVIEW

• C. R. Fredo Anders Hedlund [2] in this paper just maintained plate exhibits that around ten times the

normal repeat of the key mode can be extended. To create plate partitions the change strategy could show up than the essential bar structure. The clatter transmission is on a very basic level diminished out of rigging as an aftereffect of hullabaloo transmission tops to be moved into satisfactory RPM ranges.

- A.B. Deshmukh et al., [3] in this paper they perceive the weight diminishing, cost saving potential and recognize the included extent and specific parts ID for more layer damping material. The target of the paper is to reduce the bustle ensuing to testing under another of conditions exhibited potential focal points of usage of settled layer damping and broke down the execution to the extent uproar, vibration and savagery qualities and fundamental essentials.
- Mahesh suresh sabale et al., [4] to diminishing release a growing weight on a couple of countries and vehicle create, light weight courses of action are required. To satisfy the quality and immovability and to use the vehicle rollover was investigated, for more efficiency and to decrease mass the upsides of new material. Promptly to secure the vehicle housetop with new material and new framework a liberal edge of the survival zone controlled by standard.
- Sainath A. Waghmare et al., [5] to reduction release an extending weight on a couple of countries and vehicle manufactures, light weight plans are required. To satisfy the quality and immovability and to use the vehicle rollover was inquired about, for more profitability and to lessen mass the benefits of new material. Promptly to secure the vehicle housetop with new material and new blueprint a liberal edge of the survival zone controlled by standard.
- Mingzhi mao et al., [6] showed standard, for instance, FMVSS 208 AND 216 have for the most part used as a piece of honest to goodness housetop squash to prosperity coordination of vehicle structure. For different road conditions for vehicle security to accomplish the same target Europe is endeavoring. The course of action of productive housetop pound the progression of good steadfast quality predicts certifiable incidents. In the squash qualities real test which ever shown the results were affirmed and demonstrated awesome affirmation.

III. WORK CARRIED IN EXPERIMENTAL ANALYSIS



Fig.1. Experimental analysis setup

Exploratory examination is used to acknowledge the particular examination result and we are just in the field of component. In this suspect the fact is to do free point of confinement condition. The housetop part is hanged uninhibitedly using holders and is showed up as a part of the figure to minimize the nervousness in section and to allow the unyielding body modes got from housetop.



Fig.2. Automotive car floor with damper

In the wake of hanging the roof part, on the surface of segment demonstrated the focuses to gage the trademark frequencies (there are 130 focuses set apart in the rooftop surface). A more diminutive than basic accelerometer is altered at certain reference point (here reference point is 70) for the game-plan of FRF's estimation. Accelerometer is associated with DSA (Computerized Signal Analyzer) through channel and other channel to pound. The entire setup is associated with Portable PC or PC to complete the examination, in Tablet or PC the ME scope programming ought to displayed right on time before begin of examination. This diversion - arrangements of trial is appeared in figure underneath. Table no. 1: Frequency at modes without damper

Frequency with Damper:

Mode shape number	Frequency (Hz)
7	53.9
8	91.1
9	109
10	141
11	166
12	188

Table no. 2: Frequency at modes with damper

Mode shape number	Frequency (Hz)
7	50.6
8	90.9
9	108
10	139
11	163
12	186

IV. WORK CARRIED OUT IN FEA METHOD

The essential prerequisite of the FEA is the geometry of the part which is created by utilizing the product known as CATIA V5 R20, CATIA is as multiplatform CAD/CAM/CAE programming suite created by the French organization Dassault framework. This product helps us in the making of the geometry precisely with the easy to understand summons for the better modular. At that point after the displaying, this modular is foreign by the lattice programming for the following procedure called coinciding. The beneath figure demonstrates the CATIA model,



Fig.3. CATIA Model of Automotive Car Floor

Frequency without Damper:

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Nodes (grids)		19862		
Elemen	nts		19882	
Mesh ty	Mesh type SHELL ELEMENTS		LL ELEMENTS	
	Table no.3	3: Meshing para	imeters	
SL. No	Eleme	ent type	Number of elements	
1	S4		18989	
2	TRIA3		893	
Ţ	TOTAL		19882	
	Table no. 4:	Elemental chara	acteristics	_
PROPERTIES		VALUES		
Young'	g's modulus		2.1E3 N/mm ²	
De	ensity		7 9E-9 Tonne/mm ³	F

PROPERTIES		VALUES	
Young's modu	lus	2.1E3 N/mm ²	
Density		7.9E-9 Tonne/mm ³	
Poisson's ratio		0.3	
Thickness		1.5mm	
Table no. 5: Material properties			

V. NUMERICAL ANALYSIS

Free-Fee condition:

Here we are deciding the recurrence, mode shape and damping variable for the structure on the premise of the condition,

• fee-free condition

The above condition we need to manage damper and without damper. At last we need to look at the consequences of FEA and EMA for the improvement.

Result o	n free-	free co	ndition	without	damner.
Result 0	in nee-	nee co.	nunuon	without	uamper.

Mode shape number	Frequency (Hz)
7	56.81
8	97.72
9	114.62
10	146.51
11	170.41
12	192.31

Table no. 6: Frequency at modes without damping





Step: Step-1 Mode 12 : Value = 1.21373E+06 Freq = 192.31 (cycles/time) Primary Var: U, Magnitude Deformed Var: U Deformation Scale Factor: +1.299e+02

Fig.4. 12th Mode Shape

Result on free-free condition with damper:

Mode shape number	Frequency (Hz)
7	54.61
8	92.52
9	110.43
10	140.58
11	168.32
12	189.21

Table no. 7: Frequency at mode considering damping

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Step: Step-1 Mode 12 : Value = 1.03213E+06 Freq = 189.21 (cycles/time) Primary Var: U, Magnitude Deformed Var: U Deformation Scale Factor: +1.299e+02

Fig.5. 12th Mode Shape

VI. COMPARISIONS

EXPERIMENTAL METHOD			
	Without damper	With damper	
Mode shape number	Frequency(Hz)	Frequency(Hz)	
7	53.9	50.6	
8	91.1	90.9	
9	109	108	
10	141	139	
11	166	163	
12	188	186	

Table no. 8: Comparison of frequencies considering with damping and without damping for expt. method

FEA METHOD			
	Without damper	With damper	
Mode shape number	Frequency(Hz)	Frequency(Hz)	
7	56.81	54.61	
8	97.72	92.52	
9	114.62	110.43	
10	146.51	140.58	
11	170.41	168.32	
12	192.31	189.21	

Table no. 9: Comparison of frequencies considering with damping and without

damping for FEA method

VII.CONCLUSION

The helper vibration excitations of auto vehicle are made by an extensive variety of sources. In our undertaking

we have consider one of the key segment of auto vehicle that is auto floor model vibration excitation under free condition. Firstly the showing is refined for the auto floor model in CATIA and corresponded in HYPERMESH then the FEM measured examination was passed on out using ABAQUS as a solver. Additionally, exploratory secluded examination was driven using FFT analyser. To got the eventual outcomes of particular parameters by FEM and FFT examination of without stiffener condition. To acknowledge the FEM results with FFT examination results. To improve the secluded parameters by incorporating stiffener in the structure T-portion are welded on the deterministic supplementary vibration floor locale. Again both FEM and FFT examination was directed to with stiffener condition.

Finally got the results and it's acknowledged. Up to 6th mode for floor, it shows as unbending condition where the movements are compelled under sans free condition. In X, Y and Z tomahawks these have three translatory and rotational modes. So in our examination we have disregarded the initial six modes.

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