

Optimization of NVH Analysis of a Small Segment of Car Roof by Experimental Method and Validating it by FEA method

Rajesh A G¹, Manjunath H S², Byregowda K C³, Preethi K⁴

^{1, 2, 3, 4} Department of Mechanical Engineering

^{1, 2, 3, 4} Dr. Ambedkar Institute of Technology, Bengaluru, India

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.

Frequency without Damper:

Table no. 1: Frequency at modes without damper

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

Frequency with Damper:

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,

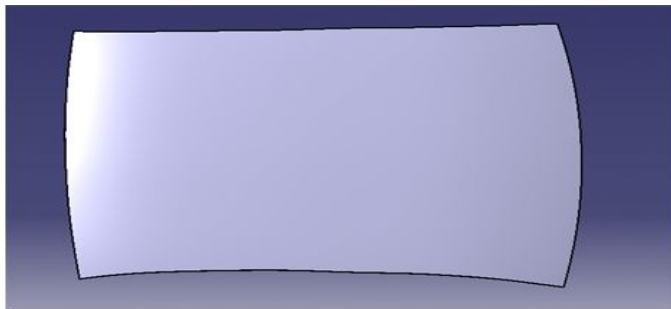


Fig.3. CATIA Model of Automotive Car Floor

Table no.3: Meshing parameters

Nodes (grids)	19862
Elements	19882
Mesh type	SHELL ELEMENTS

Table no. 4: Elemental characteristics

SL. No	Element type	Number of elements
1	S4	18989
2	TRIA3	893
TOTAL		19882

Table no. 5: Material properties

PROPERTIES	VALUES
Young's modulus	2.1E3 N/mm ²
Density	7.9E-9 Tonne/mm ³
Poisson's ratio	0.3
Thickness	1.5mm

V. NUMERICAL ANALYSIS

Free-Free condition:

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

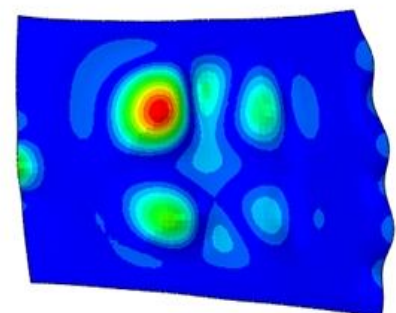
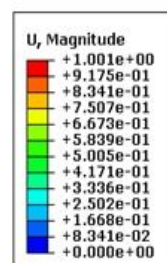
- free-free condition

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 on free-free condition without damper :

Table no. 6: Frequency at modes without damping

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



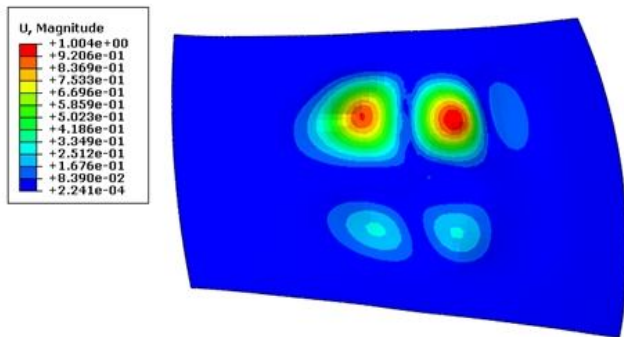
Step: Step-1
 Mode 12 : Value = 1.21373E+06 Freq = 192.31 (cycles/time)
 Primary Var: U, Magnitude
 Deformed Var: U Deformation Scale Factor: +1.299e+02

Fig.4. 12th Mode Shape

Result on free-free condition with damper:

Table no. 7: Frequency at mode considering damping

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



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. COMPARISONS

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

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. 9: Comparison of frequencies considering with damping and without damping for FEA 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

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.

BIBLIOGRAPHY

[1] Mode calculation and testing of a car body in white- Ying yang, Guangyo Zhao, Dongbo Ma, Xiaobin Xu. Shock

and vibration 18(2001) 289-298 DOI 10.3233/SAV-2010-0604 IOS Press.

- [2] NVH optimization of truck cab floor panel embossing pattern- C.R. Fredo Anders Hedlund 2005-01-2342.
- [3] Case study on sandwich steel application in automotive BIW for NVH improvements - A.B.Deshmukh, S.V. Chaitanya, Sachin Wagh IOSR 2278-1684 ISSN (P):2320-334 XPP: 0106.
- [4] Design and analysis of automotive roof by using modern material forms like plastics as an effective alternative - Mahesh Suresh Sabale, N. Vivekanandan, Swapnil S. Kulkarni IJAERSE- ISSN 2249-8974.
- [5] Strategic selection of alternative material for automotive roof to improve crashworthiness in rollover accidents - Sainath A. Waghmare, Prashanth D. Deshmukh- IJETAE ISSN 2250-2459, Vol-4, issue 6,june 2014.
- [6] Design of light weight magnesium car body structure under crash and vibration constraints- Mingzhi mao et al
- [7] Modal analysis of body in white - G.R.Nikhade. (IJIRSE) International Journal of Innovative Research in Science and Engineering ISSN (online) 2347-3207.
- [8] Design through FEA for plastic composite material for suitability to automotive roof with compliance to 'roof crush' regulations - Darshan.K.Thakur, Prof. Devendra Sadaphale, Swapnil Kulkarni. International journal of advanced engineering research and studies E-ISSN 2249-8974.
- [9] Specialized noise control materials in the automotive industry- Sharad. R. Mahajan, Prasad Vilas Bapat (IJESE) ISSN: 2319-6378, Volume-2 Issue-1, Nov-2013.