A Review Paper: Design Optimization of Mirror Post Assembly for Achieving Desired Natural Frequency

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Abstract- The automobiles experience a lot of vibration which cause the mountings to vibrate. These vibrations may hamper the working of the parts. Car mirrors are the mounting which are the most reliable source to check the rear sides of the vehicle. The rear view mirrors must have provided a stable view to the driver when driving. It is thus necessary that design should be robust and avoid resonance. To study the vibrations finite element method and experimental approaches are the only approaches. The finite element analysis method provides helps in determining the natural frequencies and mode shapes. The rear view mirror post will be checked for any resonance using finite element analysis and design will be modified to get optimum results

Key words **–** Natural frequency,Computational modelling, Vibration, FEA, Modal analysis, finite part methodology (FEM), excitation frequency, ANSYS

I. INTRODUCTION

In India public transport is mostly through passenger commercial vehicle. Working area of people is not near to living area. Many cities are specially design in which residential area and industrial area are separately located. Many people come from small town to big cities for job every day. Town people have to use commercial vehicle for transit. According to safety commercial vehicle is very useful for long distance. In rural areas commercial vehicles used within town also. It is not possible to everyone to use their own vehicle or have their own vehicle. Cities like Delhi, Mumbai and Pune most people use public transport services. Public transport is a necessity in bigger cities.

Passenger commercial vehicles are specially design for transporting. Bus is type of passenger commercial vehicle. Bus is road vehicle which carries passengers as much as possible with comfort and safety. Buses have capacity as high as possible. Bus is good option for commutation and it is economical also. Safety of passengers is main concern in designing of buses. Driver has to deal with many things during his job. Our cities are crowded having huge number of vehicles on road especially at peak hours. Everyone is in hurry to reach somewhere and lack of discipline is also at its peak at this time. Its driver's responsibility to make the journey safe for passengers. Passenger safety is start from entry in the bus up to exit from bus. Passenger should feel safe during the journey. Problems occur during entry and exit of bus. More rush leads to accident while entering and taking exit from bus. Bus provides wide doors for entry and exit.

Driver has some controls to drive safely. Bus has very good arrangement for safely entry of passengers as shown in Fig 1. But only this provision is not sufficient for safety of passenger in rush hours. Driver has to look after the outlets while stopping and leaving at the bus stops. Rear mirror arrangement is provided to the bus for driver's help. Arrangement of side mirrors is design so that he can able to judge correctly what is around of vehicle.

BACKGROUND OF STUDY

Accident occurs due to ignorance of safety on road. Some people thinks that accident occurs is due to their luck. Some reason is present in every accident. Some default, malfunctioning or negligence leads to accident. From last few years count of accident is increasing. Every day many people killed or get injured in one or other type of road accident. Count of people increasing and use of public transport is also increasing. Road structure for any cities is also has some limitation, so it leads to increased rush. Situation for public transport is becoming very difficult, especially for bus drivers. Sometimes they have to drive bus with so many extra passengers. Driver has to drive with lot more concentration. He has responsibility of safety of all passengers even if it is more than capacity of bus.

Fig1 - Bus accident in city traffic

MALFUNCTIONING OF MIRROR.

Mirror arrangement is very much important for driver. If position of mirror changes then driver cannot use it properly. Driver normally uses it to get rear view but dislocation or angle alteration of mirror create problem for driver. Loose joint of bracket and bus body leads to vibrate whole structure and driver cannot get expected view. Fault in joint between mirror and bracket again creates problem of driver. Convex curve of mirror is should be perfect to get proper reflection.

Fig2 - Solution used for resonance of RVSM

These are problems relates with faults in assemblies of mirror and bracket behind it. If we assure all of these assemblies make perfect, it does not assure that mirror will perform correctly. Even if we make all this arrangement are correct, vibration comes from body creates problems for mirror assemblies. It starts to vibrate and it is not possible for driver to judge from that vibrating view from mirror. These vibration modes depend on structure, geometry and its material.

II.PROBLEM STATEMENT

To find out reason of vibration in structure as per customer requirement and provide optimum solution for structure.

A) Objectives

- To find natural frequencies of the existing design and correlation of results.
- Carry out iterations for improving the design and FEA of all designs
- Result correlation of final design

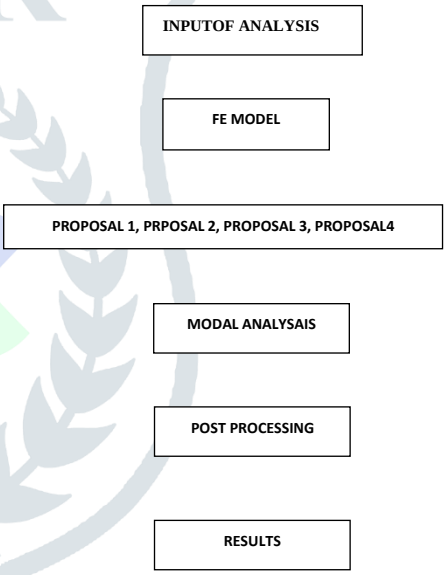
B) Scope

- During this venture vibrational study using FEA and FFT analyser to be done.
- To examine which methods are available for measuring natural frequency.
- Find out which parameter will affect natural frequency of the mirror post
- Know how to eliminate vibration of sources to get affected on automotive accessories
- Finding best iteration of design on the basis of natural frequency

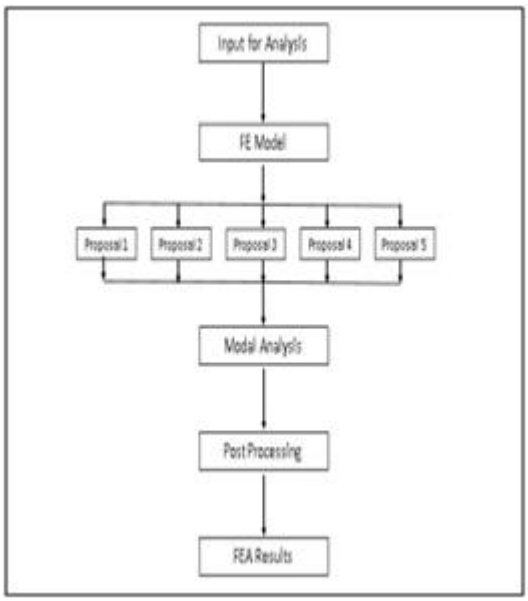
III. METHODOLOGY

- Before doing analysis it is suggested to perform the experimental analysis. To find natural frequencies FFT analyser is used. Modes and frequencies are collected using the FFT analyser and will be compared with FEA results.
- Experimentation of Existing plan: The modular investigation of the RVSM to be done to locate the principal examination. The setup to be made to for the free vibration. The RVSM will fix in the setup and mallet will be utilized to bang the mirror. The underlying excitation was given and vibrations were noted utilizing FFT analyser. From the experimental examination it will see that characteristic frequencies of the current structure were close as far as possible depicted by JIS. As there is reverberation, the abundance vibrations will be seen in the current design.
- Modification of design: To avoid the vibrations caused in view of the mirror, it is important to add the stffness to the mirror. Regular frequency is rely upon stiffness of mirror section structure and mass of entire structure. From connection we can say that regular frequency is specifically relative to solidness and contrarily extent to mass of structure. On the off chance that solidness of structure expands, at that point common frequency of structure increments. In the event that firmness of structure diminishes, at that point normal frequency of structure diminishes (Mass kept constant). .. $F_n \alpha K$ and $f_n \alpha \frac{1}{m}$. If mass of structure increases, then natural frequency of structure decreases. If mass of structure decreases then natural frequency of structure increases (Stiffness kept constant).
- Preparation of proposals and analysis of same.
- Selection of optimum solution from proposals.

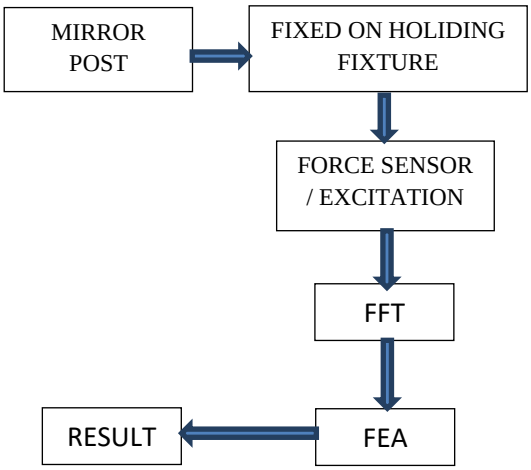
IV. CONCEPT OF MODAL ANALYSIS PROCESS



Flow chart 1- Modal analysis process



V. CONCEPT OF EXPERIMENTAL PROCESS



Flow chart 2 - Experimental process

V. LITERATURE REVIEW

Zhiping Zhang, [1] to improve the safety of the moving car, they have to make simulation and analysis of the dynamic characteristics of the car rear-view mirror. They consider, in addition to the geometric dimensions, standards and demands, a reasonable choice of the mirror size and installing position, the dynamic characteristics of the car rear-view mirror in the design of the car rear-view mirror. In this paper, they use the finite element software ANSYS to simulate the vibration frequency and vibration modals of the car rear-view mirror under the condition of excitation sources. Based on this and the strength analysis results of the rear-view mirror, they make an optimal design of the rear-view mirror structure. The results show that because of the low modal frequency, the car rear-view mirror is easily inspired by the engine, powertrain system and road to vibrate.

Antoine Larchez [2] Cost of product is very much important in competitive world today. Earlier manufacturers wasted lot of budget on preparing several prototypes. The new techniques developed in last few years has changed prototype making scenario completely. Finite element analysis (FEA) is the area of work which has brought revolution. Cost of prototype making and testing is reduced many folds. One can create multiple design iterations virtually. This is followed by design validation. The iterative process is repeated till the design is validated for all the expected criteria. There are many tools commercially available to carry out the job. Virtual analysis has not only helped in making products better but also it has practically reduced the time to market for manufacturer.

Yogesh kothawade[3] Vibrational study of automobile outer rear view mirror. The external and internal mirrors used particularly in high mass recreational and commercial vehicles are prone to vibrations. Effect of undesired vibrations in the mirror assembly like blurring of image, breaking of the mirror glass, breaking of plastic mounting bracket due to resonance is a major challenge and requires vibration analysis based studies during the development stage of the mirror assembly. The purpose of this study was to carry out vibration analysis on a basic pre-existing mirror assembly from an OEM (original equipment manufacturer) and further develop this assembly to increase its first fundamental frequency above the target specified by the OEM. Finite element model for the automobile rear view mirror was created to predict mirror vibration response based on modal analysis study.

Trupti Nirmal [4] Finite element model for the automobile rear view mirror was created to predict mirror vibration response based on modal analysis study. The materials used in this FEA model were initially provided by the mirror manufacturer and also some modification was done based on the study. Hyper mesh Optistruct solver was used to build the complete FEA ORVM model. Vibration modes were predicted for the mirror assembly with a special focus on the mirror mounting bracket as it's the only part through which the vibrations transfers to mirror assembly in actual vehicle. The natural frequency of the first mirror FEA model was correlated with the first test results and then further iterations were done using this FEA model to predict the changes required in material and geometry to achieve the target frequency value. The current paper, as a part of curricular activity of Master's program, focuses on the basics of vibration, importance of vibration study in an automobile mirror and use of CAD & CAE software in the development and optimization of a mirror assembly based on its mechanical behaviour

Santosh S. Mangade1 [5] According to Indian standard the frequency range given for the back view reflect is extending from 0-50Hz however results gotten by the primary characteristic frequency of the mirror is more than the 50Hz. Motor excitation frequency is around 58 to 67Hz so there are odds of reverberation. From experiment, it has been seen that the pinnacle of first normal frequency of the mirror get together is at 59Hz and the main mode shape is interpretation and pivot about Y-hub and opposite to Z-hub. There is great relationship between's experimental outcome and FEA results for first common frequency and mode shape. Second top for regular frequency is at 60Hz from the experiment in Y course. FEA result likewise demonstrates a similar pattern. Second regular frequency from the modular examination indicates 65Hz which is near the experimented esteem. Second mode of the vibration is rotational and interpretation in Y-pivot. The initial two modes are confused modes as the body go about as a cantilever shaft. Results demonstrate that the initial two frequencies which only the most working frequencies of the bike which cover with the motor excitation and that is the reason of reverberation. This reverberation obscures the picture which found in the mirror. In symphonies investigation they energized the structure by outside power by keeping the help fixed. First pinnacle appeared in consonant examination is likewise near 58Hz and 65Hz. This demonstrates it have to expand characteristic frequencies over the working frequency range of the motor which is running from 58 TO 67 Hz.

PravinPatil[6] This paper manages the methodical investigation of the relationship among's test and FEA results utilizing RADIOSS. Modular examination is performed to discover common frequency and mode state of framework. Modular examination results are utilized as contribution for reaction investigation. Modular Effective mass estimation demonstrates standard mirror post will

vibrate all the more amid motor inactive rpm, as having high modular powerful mass portion. High removal saw in standard mirror post in FEA results and contrasted and test results. The great connection saw between test outcomes and FEA results.

BirajdarSurajSadadeo[7] The base mirror model was studied in various aspects and after much iteration six important design modification proposals were shared with the manufacturer showing increasing trend of first natural mode of mirror assembly. FE results were validated by the lab test and a good match was observed for Proposal-6, which also met the weight constraint and found feasible for manufacturing.

VI. CONCLUSION

This current test considered on "Design Optimization of Mirror Post Assembly for Achieving Desired Natural Frequency" has cleared the impact of different parameters on the vibration body.
Automobile and Ancillary industry design parts with considering its standards. Each design has minimum 3/4 alternatives while designing. The finalized design is the optimized one. Optimum design is decided on basis of part's functional ability and its cost.
RVSM vibrate at its resonant frequency. Every different structure has its own natural frequency. If Natural frequency coincides with source vibration frequency then structure starts vibrate with large amplitude at its peak. It is necessary to find out natural frequency of every proposal for vibration proof structure during working condition. Natural frequency can be found out by actual testing method which means testing of proposals under actual working condition in test lab on test rig. But it is not economical to manufacture every proposal for testing. Then second method is to do analysis through software. It saves cost and it is very much important in competitive market. Vibration analysis is carried out for finding its dynamic behaviour. In that Modal analysis is way to find out natural frequency and its mode of vibration.

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