Selection and Placement of Anti Vibration Mounts Under A Compressor Skid and Verification of Result using FEA

[1]Madhura Borole, [2]Rucha Boid, [3]Aditya Darak, [4]Mukul Chaudhary, [5]Dr.Amar P. Pandhare
[1]Student, Department of Mechanical Engineering, Smt. Kashibai Navale College of Engineering, Pune, madhuraborole@gmail.com
[2]Student, Department of Mechanical Engineering, Smt. Kashibai Navale College of Engineering, Pune, ruchaboid16@gmail.com
[3]Student, Department of Mechanical Engineering, Smt. Kashibai Navale College of Engineering, Pune, darakaditya11@gmail.com
[4]Student, Department of Mechanical Engineering, Smt. Kashibai Navale College of Engineering, Pune, mukulchaudhary1995@gmail.com
[5]Professor, Department of Mechanical Engineering, Smt. Kashibai Navale College of Engineering, Pune, amarppandhare@gmail.com

ABSTRACT

This paper deals with the methodology of selection of Anti Vibration Mounts (AVM) and finding the optimal positions of Anti Vibration Mounts under a Compressor base frame. The Anti-Vibration mounts are first selected. The loading of Anti-Vibration Mounts is done in static loading condition. Linear Static Analysis is done by using Hypermesh. The final positions are found by Optimization software (Hyperstudy).

Keywords: ***Optimization, Hypermesh, Hyperstudy, Anti Vibration Mount***

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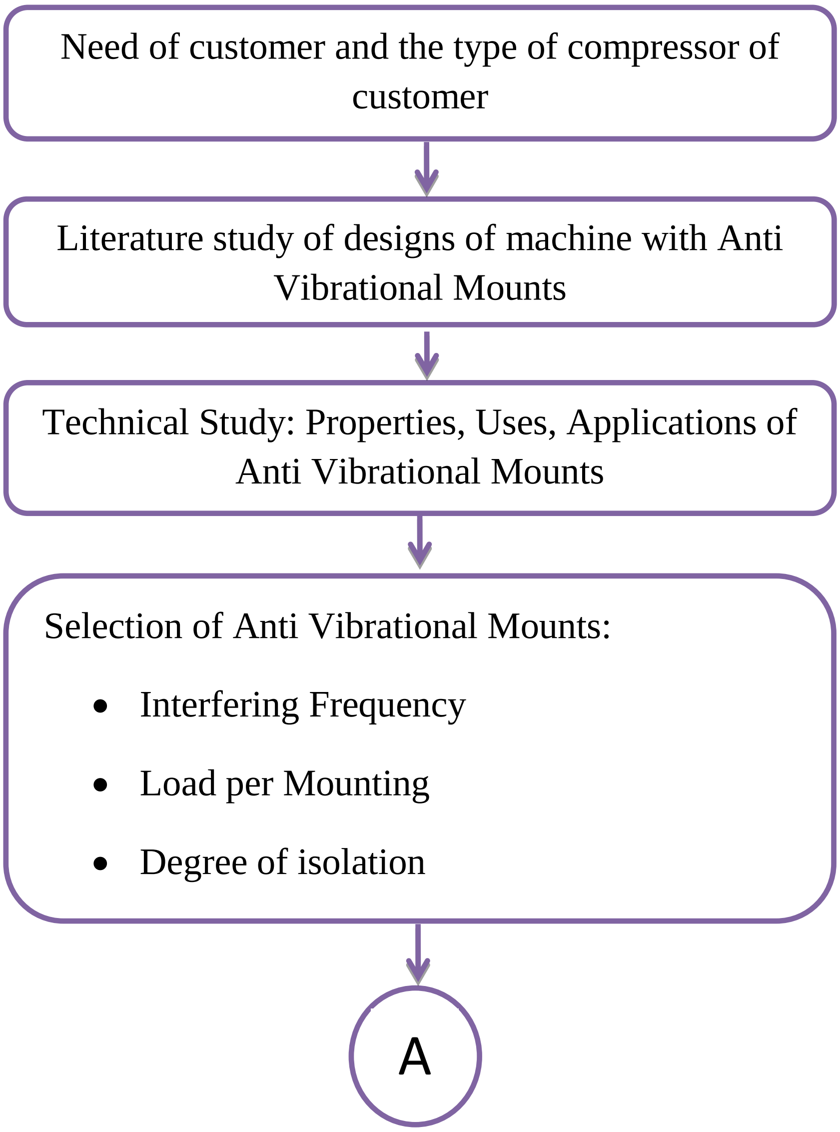
1. INTRODUCTION

Mechanical vibrations and the shocks and noise caused by them are becoming increasingly severe in modern technological society. The intensity of vibrations is closely connected with the main trends of contemporary technology. First of all, the increase of machine efficiency, obtained by increasing operational velocities, power and load obviously causes an intensification of superfluous dynamic interactions. In addition, new and more severe environment conditions (e.g. high or very low temperatures or pressures), new materials and new requirements stimulate the development of new machines and new technologies. Second, the weight and dimensional optimization i.e., mainly minimization of machines, which reduces their rigidity can, in turn, give role to an increase in vibration. These trends, with the mass utilization of technical means, lead to an increase of intensity in vibrational and acoustical fields and create a menace for man and his environment.
The protection of the human environment from hazardous vibrational and acoustical fields should naturally begin at the very source: machines must be designed in such a way that the level of transmitted vibrations and noise is kept within admissible limits. The control of vibration in mechanical systems subjected to vibration excitation, characteristic of modern aerospace, marine and ground dynamic environments, has become one of the most challenging problems for the engineering analyst and designer. They are faced with the task of finding a solution to determine in excess problem with many contradictory requirements.
The role of Vibration Control may be formulated as follows: to provide maximum efficiency in essential machine operation and minimum secondary distress effects, mainly in the nature of vibrations and noise. This purpose can, in practice, be reached by means of a proper construction of the machine and its parameters (inertia and rigidity in particular) with given (predicted, calculated, measured) external influences (a way or supplying energy). An important, although secondary tool in Vibration Control is damping. Damping is connected with the dissipation of energy, usually irreversibly converted into heat, so that it causes a reduction of the general efficiency of the machine. The ideal performance of a machine should involve minimal damping, but obviously damping is extremely useful in attenuating all perturbing vibrations.

2. SCOPE

To determine the optimal locations of Anti Vibration Mounts under the compressor skid such that they share almost equal load and load on each Anti Vibration Mount to be below 80% of rated capacity. There should be ease in obtaining optimal locations of Anti Vibration Mounts.

3. METHODOLOGY



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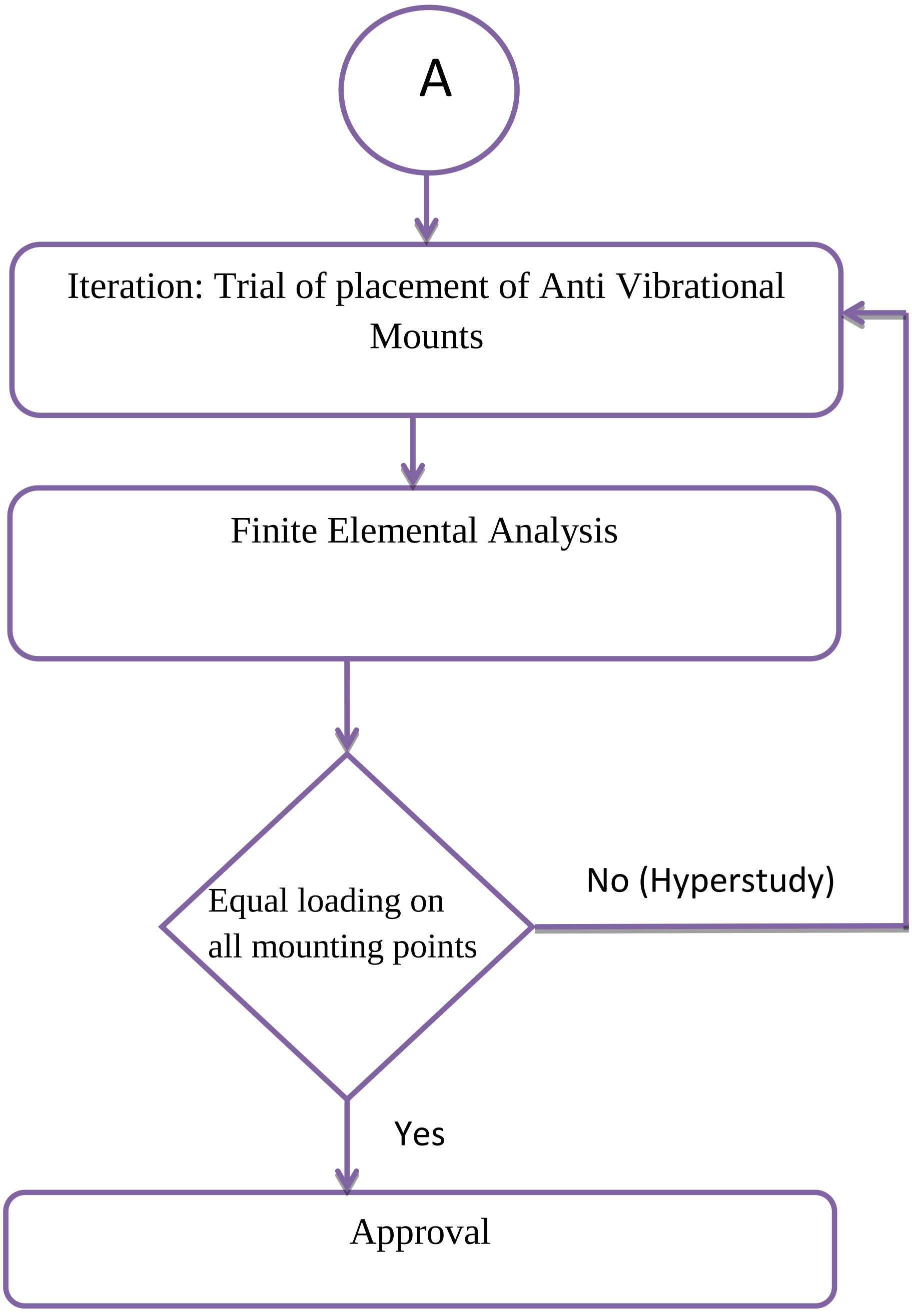

4. PROCEDURE

We modeled a simple line diagram of the Compressor base frame in Hypermesh by locating the four corner points and CG. The AVMs were selected using the selection procedure specified by the AVM supplier. The AVM required was selected suitable our requirements by using 3 AVM selection graphs provided by the supplier. The AVMs were placed at different locations on the skid i.e. the initial mounting points of the Compressor base frame (Number of initial mounting points=11). AVMs are represented by spring elements in the Finite Element Model. The stiffness is calculated by the number of AVMs, total load on the base frame and the static deflection of the AVM.

Given:

Package mass= 10293 kg

No. of mounting points on base frame= 11

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Motor rpm= 3000 rpm (270 hp)

Thus, Load per mounting= 10293/11

= 935.73 kg

≈ 1000 kg

Interfering Frequency= motor rpm/60

= 3000/60

= 50 Hz

Since, h= 43 mm (Value obtained from Trelleborg AVM datasheet) [1]

Static Deflection= 35 mm (Value obtained from Trelleborg AVM selection graph) [1]

Percentage deflection in static loading= (35*100)/43

= 81.4%

- The selection of this Anti Vibration Mount is not feasible.
- Thus, the other Anti Vibration Mount, i.e. M1500-60 is chosen and the calculation is repeated.

Since, h= 43 mm (Value obtained from Trelleborg AVM datasheet) [1]

Static Deflection= 18 mm (Value obtained from Trelleborg AVM selection graph) [1]

Percentage deflection in static loading= (18*100)/43

= 41.86% (i.e. less than 50%)

The maximum load capacity of M1500-60= 2500 kg.

And, 1000 kg < 80% of 2500=2000 kg

- The selection of this Anti Vibration Mount is feasible.
- Thus, the Anti-Vibration Mount, i.e. **M1500-60** is selected.

In order to optimize these AVM positions we use optimization software called Hyperstudy. It optimizes the position AVM within provided upper and lower limits of position for that specific AVM.

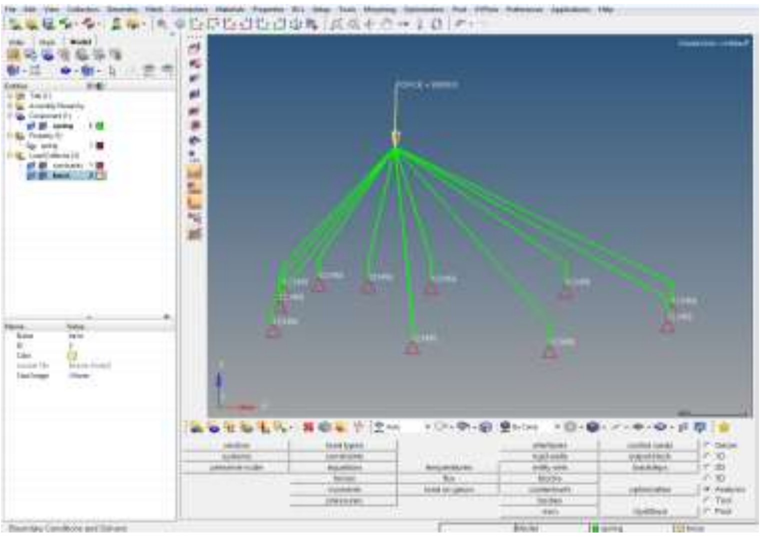

Fig-1: Simplified Finite Element Model of Compressor Base Frame with Contraints and Force

For Hyperstudy, the following data needs to be provided to the software:

Variables- Coordinates of AVMs

Responses- Reaction forces at each AVM

Constraints- Specify the minimum distance between each AVM and also the upper and lower bounds for each AVM

Objective- Reaction forces acting at each AVM should be almost equal.

Thus, the optimized position of AVMs is obtained.

5. CONCLUSION

This paper shows the way of optimizing the AVMs positions on compressor skid. We have used Hypermesh software for analysis purpose and Hyperstudy software for optimization purpose. By use of software's, it becomes convenient for doing any changes according to change in skid design. Hence it saves time and we get accurate results.

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