Fabrication & Testing of Dynamic Vibration Absorber

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Abstract— A dynamic vibration absorber or vibration neutralizer is a spring mass system which reduces or eliminate the vibrations. The dynamic vibration absorber widely used in passive vibration control system in machinery and structure. The dynamic vibration absorber is nothing but coupling of properly designed auxiliary spring mass system to the main system this auxiliary spring mass system is known as vibration absorber. The undamped dynamic vibration absorber is extremely effective at one speed only and thus it is suitable for constant speed machine. With the help of this system we are reduce or eliminate the vibrations of system by attaching spring mass system (absorber) to main system. When an absorbing mass spring system is attached to main mass and the resonance of the absorber is tuned to match that of main mass, the motion of the main mass is reduced to zero at its resonance frequency. Thus, the energy of the main mass is apparently absorbed by the tuned dynamic absorber. We are going to validate it by reducing or eliminating vibrations of main system for single speed.

Keywords: Vibration, Structure, Mass, Vibration Control, Frequency

I. INTRODUCTION

A dynamic vibration absorber or vibration neutralizer is a spring mass system which reduces or eliminates the vibrations. The dynamic vibration absorber widely used in passive vibration control system in machinery and structure. The dynamic vibration absorber is nothing but coupling of properly designed auxiliary spring mass system to the main system this auxiliary spring mass system is known as vibration absorber. Dynamic vibration absorbers are very fundamental devices when it comes to vibration management in systems, and their effects are interesting to even those outside of the field of engineering. The concept behind these passive components is simply to add a spring and mass that have a natural frequency tuned to that of the resonant excitation frequency of the system. Doing so transfers all of the resonance energy of the system to the DVA, leaving the original system undisturbed.

The auxiliary spring mass system is known as vibration absorber. After coupling the absorber to the system, the mass which is excited before attaching absorber can now have zero amplitude of vibration and the spring mass system which is coupled to it is now vibrated freely.

Source: A mechanical or fluid disturbance, generated internally by the machine, such as unbalance, torque pulsations, gear tooth meshing, fan blade passing, etc. These typical occur at frequencies which are integer multiples of the rotating frequency of the machine.

Path: The structural or airborne path by which the disturbance is transmitted to the receiver

Receiver: The responding system, generally having many natural frequencies which can potentially be excited by vibration frequencies generated by the source.

II. LITERATURE REVIEW

Milind U. Karanjkar et al., 2017 the problem indicated at their end for air blower were Heavy corrosion on the impeller due to corrosive environment & though it complies with I.S.-1940 vibration norms, it creates unwanted irritating sound, which can be termed as noise pollution. The root cause of noise pollution is vibration, which is the result of uneven mass distribution and can be termed as manufacturing defects. Secondly, improper clamping of the mating parts can result in vibrations. Vibrations are generally observed when a system or a element which is subjected to dynamic forces which can be periodic or random, linear or rotational.

Ghanshyam. G. Iratkar et al., 2017 Centrifugal pumps are the simplest equipment used in any process plant. Centrifugal pumps are commonly used in processing plants, water supply plants, steam power plants, oil refineries, etc. Its purpose is to convert the energy of an electric motor or turbine into the kinetic energy and then into pressure energy of a liquid that is being pumped. The energy changes take place with the help of two main components i.e. the impeller and the volute or diffuser. The impeller is the rotating component that converts input energy into the kinetic energy. In this paper, a literature survey is done on centrifugal pump impeller and its design and structural/static analysis using FEA Software for different materials.

Dr. Vinayak R. Naik et al., 2018 A design methodology to examine various parameters of the centrifugal blower using computational fluid dynamics approach. The effects of blower geometry, blower speed, impeller geometry, and blade height and impeller diameter have been assessed. Noise level and speed are the output parameters calculated. High rotating frequency of blower produces high level of noise. Thus, noise reduction is key parameter in design of hand blower. Using Computational fluid dynamics (CFD) noise source is analyzed. A different combination of blower geometry, impeller diameter, blade height, no of blades is carried out and is optimized for noise reduction.

III. PROBLEM STATEMENT

To fabricate the model of vibration absorber which can be used to reduce or eliminate the frequency of machine by using spring mass system by using this system can help to absorb the vibration which are develop while working of machine and absorber can help to reduce and absorb the frequency and machine can work continuously without any error.

IV. OBJECTIVES

Material	Configuration	Properties
Frame	12" x 21.5"	M.S
Motor	161382 geared motor	Std.
Eccentric mass	4" x 4" x0.25”	Brass

Screw, nut and bolts	Std.	Std.
DC power supply	12VDC and 600mA,	Std.

Table 1

There are few objectives of the project. The aim of this project is to eliminate or reduce the vibration of main system by adding or attaching spring mass system (absorber).

- To protect the main system.
- To increase the production efficiency.
- To increase the life of product.
- To reduce the noise of machine or structure.

V. SCOPE

This study can be extended for design and optimization of impeller by changing the various performance parameters for the weight reduction and improve the corrosion resistance property. Also prediction of natural frequency with the help of modal analysis by varying the operating parameter

VI. MATERIAL SELECTION

Variable	Item	Value
M1	Platform mass	361.5
M2	Absorber mass	82.8
M0	Eccentric mass	68.5
e	Eccentricity	22.8
Klb.	Left back spring stiffness	9.95
kLF.	Left front spring stiffness	9.64
kRF.	Right back spring stiffness	9.59
kRB.	Right back spring stiffness	9.68
k1	platform spring stiffness	38.86
k2	Absorber spring stiffness	8.91

Table 2

A. Material Requirement:

In order to characterize our model, data was taken on the system components using a triple beam balance from the Systems lab along with hanging masses. Every spring was measured individually using four mass increments so that trend lines could be fit to calculate each stiffness value. Each component used for the platform and DVA assemblies was also weighed individually. The resulting system characterization values can be seen in spring stiffness graphs proved reasonably similar and linear.

B. Undamped dynamic vibration absorber

Undamped dynamic vibration absorber is extremely effective at one speed only and it is suitable only for constant speed machine. The damped dynamic vibration absorber can be used for machine with varying speed however , for the damped dynamic vibration absorber to be effective they have to be operated in a very narrow rang of natural frequencies Consider a system shown in fig having mass „m‟stiffness.

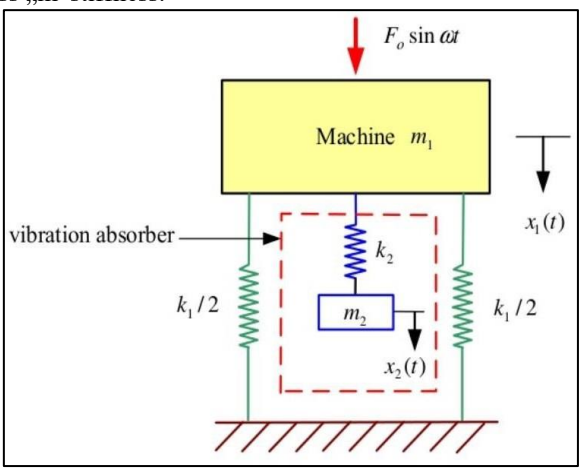

Fig. 1

„k‟whichisvibratingwithexcitationfrequency„ω‟whenthisexcitationfrequency„ω‟ is nearly close to the natural frequency „ωn‟ of the system. In such case, the vibration of the system can be reduced by using a dynamic vibration absorber, which is simply another spring mass system as shown in fig. the spring mass system (m1, k1) acts as vibration absorber having natural frequency √k1/m1 and reduce the amplitude of „m‟ to zero.

C. Concept Diagram:

The undamped dynamic vibration absorber is extremely effective at one speed only and thus it is suitable only for constant speed machine the damped dynamic vibration absorber can be used for machine with varying speed however, for the damped dynamic vibration absorber to be effective, they have to be operated in very narrow range of natural frequency

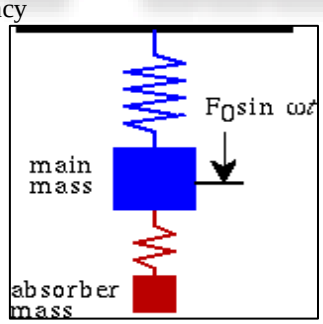

Fig. 2: The undamped dynamic vibration absorber.

Consider a system shown in fig having mass „m‟ stiffness „k‟ which is vibrating with excitation frequency „ω‟ when this excitation frequency „ω‟ is nearly close to the natural frequency „ωn‟ of the system. In such case the vibration of the system can be reduced by using a dynamic vibration absorber which is simply another spring mass system as shown in fig. the spring mass system (m1,k1) acts as vibration absorber having natural frequency √k1/m1 and reduce the amplitude of „m‟ to zero.

VII. MATHEMATICAL MODEL

A dynamic vibration absorber or vibration neutralizer is a spring mass system which reduces or eliminate the vibrations. The dynamic vibration absorber widely used in

passive vibration control system in machinery and structure. The dynamic vibration absorber is nothing but coupling of properly designed auxiliary spring mass system to the main system this auxiliary spring mass system is known as vibration absorber. The undamped dynamic vibration absorber is extremely effective at one speed only and thus it is suitable for constant speed machine. With the help of this system we are reduce or eliminate the vibrations of system by attaching spring mass system (absorber) to mainsystem.

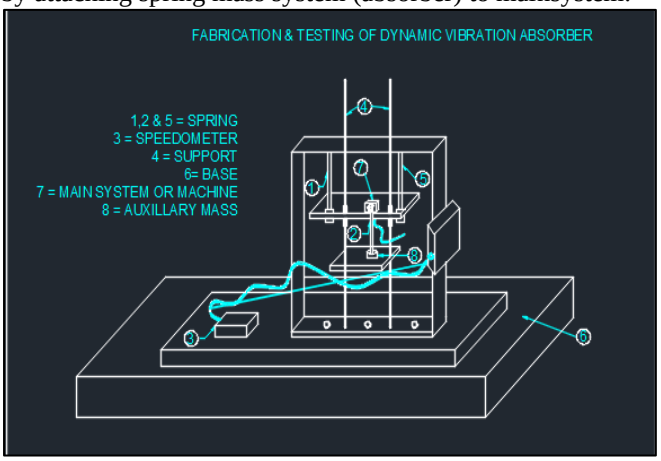

Fig. 3: CAD Model

VIII. FUTURE SCOPE

1) The undammed vibration absorber is used for only one speed
2) The damped dynamic vibration absorber can be used for machine with varying speed.
3) The damped dynamic vibration absorber to be effective they have to be operated in very narrow range of natural frequency.
4) We can use this vibration absorber using MR and ER for the variable speed.

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