A Review of Force Damped Vibration of Cantilever Beam

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Abstract— Cantilever Beam is an Element whose one end is fixed and other end is Free. Vibration occur in Beam Due to External Force. Applications like Turbo machinery blades with shrouds, windmill and T.V. towers supporting structures can be consider as a cantilever beams for purpose of analysis of forced damped vibrations. When the Vibration will maximum in the beam, Failure may be occur.Vibration problem occurs where there are rotating or moving parts in machinery, apart from the machinery itself surrounding structure also faces vibration hazards because of this vibrating machinery. The excessive stress in machine element parts caused by undesirable vibration and also affects a human comfort. Hence, reductions of undesirable vibration are essential in machinery. In this paper vibration of cantilever beam analyzed and measured at different damping condition and at various speed by FFT analyser. frequency response curve are obtained from experimental result and analyze for reduction in vibration .The investigation the paper the nature of beam vibration at various condition for different materials such as plain mild steel, aluminium,mild steel with painting and coating.

I. INTRODUCTION

The beams are very common types of structural components and can be classified into their geometric configuration such as uniform, tapered and thick. Beam has been used in many engineering applications and a large number of studies can be found in literature about vibration of non-uniform and uniform beams.Forced vibration analysis that has been done in which process of describing a structure in terms of its natural characteristics of the frequency and amplitude. The change of modal characteristics directly provides an indication of structural condition based on changes in mode shapes and frequencies of vibration.When external forces act on a vibrating system during its motion, it is termed Forced Vibration. Under this condition, the system will tend to vibrate due to its own natural frequency based upon the frequency of the exciting force. After the some time, the system will vibrate due to the frequency of the exciting force only, instead of the initial conditions own natural frequency of the system. Most of the vibration phenomenon present in life are classified under forced vibration. Damping will be necessary to maintain the amplitude at a certain level,when the excitation frequency is very close to the natural frequency of the system and vibration of amplitude will be very large. This case is known as“resonance" and it is very dangerous to structural and mechanical parts. Thus, care must be taken when designing a mechanical system by selecting proper natural frequency that is sufficiently spaced from the exciting frequency. Analysis of beam vibration now a day is very important as beam is being widely used in various applications. In various types of loading,these beams are continuously subjected.Beyond the certain limits,if the vibrations are exceed,there will be danger to failure of beam breakage. So it is important to study the vibrations in the beam and try to reduce these vibration. The analysis of moving loads on a beam structure has been a interested topic for well over a century. Interest in these problem originated in mechanical as well as civil engineering.

II. LITERATURE REVIEW

D.P. Kamble et.al
Vibration occur in Beam Due to External Force. When the Vibration will maximum in the beam, Failure may be occur. In this paper, two types of Methods are used for finding the natural Frequency of Different Modes. Analysis for all the method is carried out and results are compared Analytically and Experimentally for two material(Aluminum and Mild Steel).It is found that, Result found by analytically and experimentally is approximated same. Most of the vibrations are undesirable in machines and structures because they produce increase bearing loads, induce fatigue increased stresses, energy losses, cause wear, create passenger discomfort in vehicles, and absorb energy from the system. When the natural frequency is equal to external exciting frequency, then the resonance will occurs in the system. Due to resonance in the system, the amplitude of vibration is maximum and failure may be occurs in the system to reduce the vibration of system we should must know the value of frequency.[1]

Vipin Kumar, et.al
In structure or a machine component, the vibration characteristics (natural frequencies and mode shapes) is used to determine by Modal analysis process. In understanding control of many vibration phenomena in practice is major alternative . In this paper, comparison of the natural frequency for different material having same I and T cross- sectional beam is done. In ANSYS, the cantilever beam is designed and analyzed. The cantilever beam having one end is fixed and another end is vibrated to obtain the mode shapes , deflection and natural frequency with different load.[2]

Mateusz Romaszko, et.al
In this paper, vision method is used for analysis of forced vibrations of a homogeneous cantilever beam.Displacements of specified beam points have been determined as a function of time in directions base on measurements. A model describing the displacement of the beam with a moving holder (kinematic excitation) is presented along with formulas

defining motion of points in the plane of the beam transverse vibrations, using a specialized vision system beam vibrations are recorded experimentally.[3]

Pragnesh K. Chaudhari et.al
Modal analysis is a process of describing a structure in terms of its natural characteristics which are the natural frequency and mode shape it's a dynamic property. The change of modal characteristic directly provides force excitation of structure condition based on change in frequency and mode shape of vibration. This paper presents results of a theoretical modal analysis of beam made with different materials like aluminium and mild steel. The beams were excited assign impact hammer excitation frequency response functions were obtained using lab view. The FRFS were processed using signal express to identify the natural frequency and mode shape of mild steel and aluminium beam.[4]

Miss. Kachare Savita ,et.al
Vibration problem occurs where there are rotating or moving parts in machinery and also its surrounding structure faces vibration which is hazardous to human being because of the vibrating machinery. The undesirable vibration creates excessive stress in machine element. Undesirable noise is a partial complete failure of parts and also affects a human comfort. Hence, reductions of undesirable vibration are essential in machinery. In this paper vibration measured at different damping condition and at various speed by using strip chart recorder and electronic circuit and it analyzed on fixed beam. Frequency response curve are obtained from experimental result and analyze for reduction in vibration .The paper investigate the vibration of beam at various condition for plain and coated mild steel beam material. Forced Vibration occurs when external forces act on a vibrating system during its motion. Under this condition, the system will tend to vibrate at its own natural frequency superimposed upon the frequency of the exciting force. The system will vibrate at the frequency of the exciting force only.In fact, most of vibration phenomena present in life are categorized under forced vibration. When the excitation frequency is very close to the natural frequency of the system then the vibration amplitude will be very large and damping will be necessary to maintain the amplitude at a certain level.[5]

V. Ramamurti, et.al
The major challenge is to provide accurate damping ratio data for higher modes in transient analysis.In this paper to find out the damping ratios experimentally. Two approaches of In this paper experimental evaluation of damping ratios are discussed for two approaches free and forced vibration for different materials like mild steel, cast iron plastics and aluminum. Eleven cantilevers are taken for evaluation of uniform cross section with varying lengths for first set. Fourteen components are also examined made of these materials used in air brake system of automobiles for second set. To find the first three natural frequencies and damping ratios, the electro dynamic shaker is used in forced damped vibration. Using finite element analysis(FEA) in above methods, natural frequencies are calculated analytically.[6]

Mohd Atif Jamil et.al
The dynamic analysis of cantilever beam using virtual instrument is important in which forced vibrations are induced and measured in the beam. This vibration data is used to identify the beam's fundamental mode of vibration. The dynamic response of a mechanical system is important in the determination of the structural loads and that is dominant in contributing factor for failure. In the dynamic analysis, the loading changes rapidly.when it is subjected to dynamic load such as earthquake. The objective of dynamic analysis here is to determine structure response using LabView and explain those results to design the structure. The gradual dissipation of vibration energy caused by some damping (e.g.viscous damping, internal molecular friction, aerodynamic damping etc.) present in the system and the amplitude of the vibration results in gradual decay. Damping has very little effect on natural frequency of the system, and hence, the calculations are generally made on the basis of no damping for natural frequencies.[7]

Mohammad Vaziri, et.al
These paper presents straight, horizontal cantilever beam under a vertical load will deform into a curve. When this force is removed, the beam will return to its original shape; however, its inertia will keep the beam in motion. Thus, the beam will characteristic frequencies. If a thin film is sputtered onto the beam, the flexural rigidity will be altered. This change cause the frequency of vibrations to shift. In this paper in lateral vibration is investigated. Static and dynamic analysis are the two categories in which analysis is done. Due to the analysis, various functions are going to be shown such as displacement in the free end, critical points, shape functions, stress concentricity and nodal solution. In the piezoelectric elements, the first step of controlling the vibration called as modeling. Experimental process is done and the results are obtained in the next stage of the project. Fast Fourier Transform Analyzer is a device in which Accelerometer and particular piezoelectric element is used . The accuracy with respect to controlling of vibrations and area of modelling in a cantilever beam research is done by some scientists.[8]

D.C. Stredulinsky and J. P. Szabo
The control of radiated noise is important for naval applications. The measured forced response was reported in reference both for the bare beam and the beam with damping layer. In steel beam to apply a load at the centre-line, normal to the bottom surface and 9 mm from the tip, the vibration exciter is used. A force transducer is used to measure the applied force and the accelerometer placed at several locations along the centre-line is used to measure acceleration of the top surface of the beam. Using the direct frequency response method the forced response of the damped beam was predicted.[9]

CONCLUSION
In the present work, the study of vibration damping characteristics of different materials such as Mild steel and aluminum is the main objective.

Analysis for the reduction in vibration will be made from frequency response curves for different material which are obtained from the observations with viscous damping amplitude of vibration reduces.

Comparative study will be done during experimentation for the same material with coating to minimize the vibration.

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