Novateur Publication's
International Journal of Innovation in Engineering, Research and Technology [IJIERT]
ICITDCEME'15 Conference Proceedings
ISSN No - 2394-3696

VIBRATION LEVEL OPTIMIZATION OF LATHE MACHINE BY CONSIDERING NONLINEARITIES IN VIBRATION PAD: AN OVERVIEW

Ms. Adarsha A. Miraje
PG Student, Dept. of Mechanical Engineering,Dr. J.J. Magdum College of Engineering,
Jaysingpur, Shivaji University, Kolhapur, India

Prof. Dr. Sanjay H. Sawant
Professor, Dept. of Mechanical EngineeringDr. J.J. Magdum College of Engineering,
Jaysingpur, Shivaji University, Kolhapur, India

ABSTRACT

Shock and vibration often result in instantaneous transcendental damage and fatigue failure of structure, performance failure of instrument, overall performance drop of structure and poor dynamic characteristics of equipment. Therefore vibration isolation is most important thing in any machine. Vibrations Pads are used to reduce noise and vibration and to eliminate the need for bolting down.Visco elastic materials are used for the purpose of vibration isolation. This is one of the lowest and easy methods to reduce vibration of machine. It also helps to reduce noise. This paper tries to give an idea about the previous researches and their findings about the study of noise and vibration isolation methods.

KEYWORDS: Visco elastic material, Vibration pad, Vibration Isolation.

INTRODUCTION

The physical movement or motion of a rotating machine is normally referred to as vibration. Since the vibration frequency and amplitude cannot be measured by sight or touch, means must be employed to convert the vibration into a usable product that can be measured and analyzed. Electronics, mechanics, and chemical, physics are closely related. Therefore, it would logically follow that the conversion of the mechanical vibration into an electronic signal is the best solution. The means of converting the mechanical vibration into an electronic signal is called a transducer. The transducer output is proportionate to how fast the machine is moving (frequency) and how much the machine is moving (amplitude). The frequency describes what is wrong with the machine and the amplitude describes relative severity of the problem. More often, vibration is undesirable, wasting energy and creating unwanted sound – noise. For example, the vibration motions of engines, electric motors, or any mechanical device in operation are typically unwanted. Such vibrations can be caused by imbalances in the rotating parts, uneven friction, the meshing of gear teeth, etc. Careful designs usually minimize unwanted vibrations. When motorized equipment, such as electric motors, fans or pumps, is mounted to a solid structure, energy can be transferred from the equipment to the structure in the form of vibration. This vibration often radiates from the structure as audible noise and potentially reduces performance or damages equipment. When a machine moves, its motion induces vibration in its structure. Due to vibrations in machines the accuracy gets affected. The generally accepted methods for vibration control of industrial equipment include; Force Reduction, Mass Addition, Tuning, Isolation, and Damping. To minimize the vibrations of lathe machine we can adjust the feed and speed rate. To reduce the vibration level of lathe machine, isolation of machine is one of the most favourable criteria that can be chosen.
A vibration isolator in its most elementary form may be considered as a resilient member connecting the equipment and foundation. The function of an isolator is to reduce the magnitude of motion transmitted from a vibrating foundation to the equipment or to reduce the magnitude of force transmitted from the equipment to its foundation. The effectiveness of isolation is measured in terms of the force or motion transmitted at the point of exposure from the source. The first type is known as force isolation and the second type as motion isolation. The less force or motion transmitted the greater is the isolation. The isolator should support the vibrating system in a static state, prevent its bounce from shock excitation and isolate vibration disturbances in the complete frequency range.

DESIGN AND ANALYSIS OF ANTI-VIBRATION MOUNT FOR G+3 ELEVATOR

Patel Sanket Bharat et.al**.** Published paper on "Design and Analysis of Anti-vibration mount for G+3 Elevator". In this paper the aim is isolating the traction machine, cabin and structure with an anti-vibration mount. This mount design comprises between the conflicting requirements of acceptable damping and good isolation. In their study they used ANSYS software to get approximate calculation of dynamic and static parameter of the mount and analytically justify the structure as stable. In this, in order to conduct the analysis, both the geometry of the structure and the actions and support conditions are idealized by means of an adequate mathematical model which must also roughly reflect the stiffness conditions of the cross-sections, members, joints and interaction with the ground. Four rubber mountings made of butadiene rubber (BR) were selected. The properties of the isolator depends upon the application of load, hence weight of engine is considered for selecting them and a study of vibration isolation is carried out analytically and numerically using FEM. In this paper they concluded from the analysis that, Natural frequency of anti-vibration mount is 288.62 Hz which is certainly the safe frequency in which no resonance can occur for the particular structure, also the analyzed structure is able to bear the applied cyclic load which states the structure is safe analytically. [1]

DESIGN OPTIMIZATION FOR VIBRATION LEVEL OF ROOT BLOWER WITH NO LOAD CONDITION

Gomatesh V et.al. Published paper on "Design Optimization for Vibration Level of Root Blower with No Load Condition". The main aim of this paper is to find vibration frequency of blower. In the analysis of blower the measurements are taken at various duties like casing, foundation, bearing and timing gears. By analyzing the amount of vibration in the root blower using FFT Analyzer's they determine the main areas where the vibrations are created more than the given standard values. Analyzing the vibrations of the root blower we can provide suitable preventive measures so that the performance of the blower can be increased. As the vibrations are reduced obviously increase the life of the different components and reduce the maintenance.[2]

REVIEW OF NOISE AND VIBRATION MINIMIZATION THROUGHCONTROL

C VSR Subramanian published paper on **"**Review of Noise and Vibration Minimization through Control". In this the strategies, principles and concepts in noise and vibration control for minimization is emphasized. This paper provides the basic information for framing ideas in this particular area. In this the information related to vibro- insulation, noise level minimization, sound and vibration damping, sound and vibration isolation, vibration isolation, concept of noise and vibration, five principles of sound proofing are discussed. [3]

DEVELOPMENT OF COMPACT VIBRATION ISOLATION EQUIPMENT APPLICABLE TO EXISTING RESIDENCES—RESTORING MECHANISM UTILIZING ROLLER BEARINGS

TakeyoshiUematsuet.al**.** published paper on "Development of Compact Vibration Isolation Equipment Applicable to Existing Residences—Restoring Mechanism utilizing Roller Bearings". In this paper they developed an inexpensive vibration isolation device that is also both compact and lightweight for ease of installation. Shaking tables and relative equipment were used to test and verify the performance of the device also they concluded that even with simultaneous horizontal and vertical seismic vibration applied, the device still displayed a reduction of the acceleration in the horizontal direction equivalent to that obtained when seismic vibration was applied in a horizontal direction only, proving the device safe and effective even with up-down movement. [4]

DAMPING SYSTEM DESIGNS USING NONLINEAR FREQUENCY ANALYSIS APPROACH

Peng fei Guo submitted a thesis on "Damping System Designs using Nonlinear Frequency Analysis Approach". The main purpose of this thesis focuses on the investigation of the frequency domain analysis and design approaches for nonlinear damping systems. With the development of modern mechanical and civil engineering structures, the vibration control has become a more and more important problem for the structural system protection. Traditional frequency domain design methods for linear damping devices have been widely studied by engineers and applied in engineering practice, where the system output frequency response is equal to the input spectrum multiplied by the system frequency response function.

Based on the Ritz-Galerkin method, a new method for the evaluation of the transmissibility of nonlinear SDoF viscously damped vibration systems under general harmonic excitations is derived. The effects of damping characteristic parameters on the system transmissibility are investigated. The results reveal that properly designed nonlinear fluid viscous dampers can produce more ideal vibration control over a wide frequency range. [5]

VIBRATION ISOLATION THEORY AND PRACTICE

Christine Connolly published a paper on "Vibration Isolation Theory and Practice". The purpose of this paper is to review the different method of isolating sensitive equipment from the effects of vibrations. The passive mechanisms of springs and dampers, air tables and negative stiffness are explained and practical examples are given. Descriptions of various active systems in which actuators respond in real time to feedback from motion sensors. Ingenious mechanical design allows passive systems to work with frequencies of the order of 1 Hz. Modern accelerometers detect absolute motion and allow disconnection from vibrations of the floor. Applications include the stabilization of inter-ferometric gravitational wave detectors. [6]

VIBRATION REDUCTION OF ROTATING MACHINERY BY USING VISCOELASTIC MATERIAL SUPPORT

Sainand M. Jadhavet.al**.** Published a paper on "Vibration Reduction of Rotating Machinery by using Viscoelastic Material Support". This paper gives the information about viscoelastic material that can be used for the purpose of vibration reduction of rotating machinery. It gives the properties of viscoelastic material n how it is helpful for vibration reduction. In this paper it is concluded that undoubtedly the Viscoelastic material shows its utility as a vibration damping material and can be used as vibration isolators in variety of applications. The conducted research will provide the comparative study between the different readily available Viscoelastic materials. It helps to evaluate the effectiveness of these materials under various circumstances. The major criterion for evaluating the Viscoelastic materials was the material itself, its size and shape. The piece of materials was placed under the support and vibration amplitudes were recorded for different support distances, with and without mass unbalance etc. This Paper shows that PVC gives reduction in vibration magnitude by 11%, 34%, and 46% over natural rubber, corrugated rubber, without viscoelastic support. [7]

AN OVERVIEW OF DISARRAY IN ANALYSIS OF VIBRATION ISOLATOR SUBJECTED TO HARMONIC EXCITATION WITH NONLINEAR PARAMETERS

Mr.Rajendra V. Kerumali et.al**.**published a paper on "An Overview of Disarray in Analysis of Vibration Isolator Subjected to Harmonic Excitation with Nonlinear Parameters". In this paper the review of various paper related to analysis of vibration isolator which is subjected to harmonic motions are studied considering the nonlinear parameters and concluded that vibration isolator designed with non-linear parameters is better because most vibrations phenomenon are on-linear in nature. In earlier researches vibration isolator with linear parameters were considered but in practice the vibrations phenomenon behaves non-linear characteristic. So it is important to consider the nonlinearities of vibration isolator while designing the vibration isolator system. [8]

X. THE RESPONSE OF ROTATING MACHINES ON VISCOELASTIC SUPPORTS

M. I. Friswellet.al**.** Published paper on "The Response of Rotating Machines on Visco elastic Supports". This paper uses the internal variable approach to model the visco elastic material for the transient dynamic responses, and includes an energy dissipation model. An example of a turbo molecular pump is given, and the difficulty in balancing such machines is demonstrated. In this paper it is investigated the effect of an elastomeric support on the dynamics of a rotating machine. In particular the effect of the frequency and temperature dependent modulus has been demonstrated. Although the example was relatively simple a number of conclusions may be drawn. It was shown that the dynamic characteristics of a machine change significantly with temperature because of the changes in stiffness and damping characteristics of the elastomer. Accurate balancing of high speed machines one last omer supports is difficult when the thermal environment is likely to change. Such a change may occur because of an uncertain ambient temperature or different vibration histories causing a variation in the energy dissipation and hence temperature in the elastomeric.[9]

CONCLUSION

By the literature review importance of vibration isolation is seen. Vibration Pads are effective method used to reduce noise and vibration and to eliminate the need for bolting down. For this it is important choose proper material. This low cost method conveniently solves or prevents problems that do not warrant the use of either rubber or spring mountings. As a general rule, pads are recommended to eliminate high frequency noise, bolting, minor vibration problems in upper stories or for ground floor and non-critical applications etc.

REFERENCES

1. Patel Sanket Bharat, Shivprakash B Barve, Sandeep G Thorat and Samata S Mujumdar "Design and Analysis of Anti-vibration mount for G+3 Elevator"Accepted 10 March 2014, Available online 01 April 2014, Special Issue-3, (April 2014).
2. Gomatesh V. Malikwade, Swapnil S. Patil, Aditya A. Magdum, Avadhoot V. Khandare , Prof. A.S.Adadande, Prof.Dr.S.H.Sawant "Design Optimization for Vibration Level of Root Blower With No Load Condition",The International Journal Of Engineering And Science (IJES) Volume 4 Issue 1 January - 2015Pages 44-50ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805.
3. C VSR Subrahmanyam**"**Review of Noise and Vibration Minimization throughControl"Emirates Journal for Engineering Research, 17 (2), 23-27 (2012)(Regular Paper).
4. TakeyoshiUEMATSU, Yuji ISHIYAMA, Yasuo Aoki, Haruo KURAMOCHI, TeijiKOJIMA,Tetsuya SOGO, Hiroyuki NAKAYAMA, Eiji KOBAYASHI, Yoshikatsu NISHINO and Masahiro MIYAGI "Development of Compact Vibration Isolation Equipment Applicable to Existing Residences―Restoring Mechanism Utilizing Roller Bearings"13th World Conference on Earthquake Engineering Vancouver, B.C, and Canada August 1-6, 2004Paper No. 387.
5. Peng feiGuo, "Damping System Designs using Nonlinear Frequency Analysis Approach".
6. Christine Connolly, "Vibration Isolation Theory and Practice", Paper of Stalactite Technologies Ltd,Wakefield, UK.
7. Sainand M. Jadhav, Sanjay D. Nikhade, Sandip S. Kanase, "Vibration Reduction of Rotating Machinery by Using Viscoelastic Material Support"International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 3, Issue 2, March -April 2013, pp.258-264.
8. Mr. Rajendra V. Kerumali and Prof. Dr. S. H. Sawant "An Overview of Disarray in Analysis of Vibration Isolator Subjected to Harmonic Excitation with Nonlinear Parameters". International Journal of Engineering Research & Technology (IJERT)Vol. 3 Issues 1, January – 2014ISSN: 2278-0181
9. M. I. Friswell, J. T. Sawicki, D. J. Inman, A. W. Lees "The Response of Rotating Machines on Viscoelastic Supports" International Review of Mechanical Engineering (I.RE.M.E.), Vol.1.