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Appropriate vibration wedge selection and calculations

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Abstract

The industrial revolution, which began with the invention of the steam engine, keeps developing with the Internet of Things. The use of machinery continues to increase at every stage of this development. The majority of the machines used do work with the help of rotational movement. The interaction between the systems to which the machines are connected and the machine during the rotational force causes some problems. The biggest trigger of these problems is the uncontrollable vibrations. Due to these uncontrolled vibrations, many serious problems such as wear, cracking, and even breakage occur in the machines or the systems to which they are connected. Although it is very difficult to prevent these vibrations during the application, it is possible to keep the vibration under control. Vibration wedges are the most preferred equipment in this regard. In this article, the calculations of the vibration wedge required to control vibration and the points that should be considered in the selection of the wedge will be explained.

Introduction

Vibration is the mechanical oscillation that occurs around a point of equilibrium. This oscillating motion can be periodic, like a pendulum, or irregular and random, like the movement of a wheel on a rough and rocky road [1]. An elastic system under the influence of externally applied forces is called forcing, and oscillating movements resulting from the externally applied force are called forced vibration. If there is any energy loss or damping event, this movement is damped vibration. The remainder after the instantaneous events have disappeared is called the steady-state vibration. Discontinuous vibrations create serious problems when impacted by live loads, shocks, and impacts. Said damage is shown in Figure 1 [2]. These movements may not always be periodic, and mechanical failure from discontinuous vibration is often associated with exceeding the mechanical strength of some components. To eliminate these problems, vibration damping wedges are used.

Figure 1. Vibration Damage [2]

Material and Method

Rubber, which is a natural substance, is obtained from the rubber tree. Thanks to its high elasticity, rubber has many uses. The oil obtained from the melt is used as a solvent in further processing. Almost all of the tires obtained from rubber, which is popularly known as pure rubber, are pure [3].

Vibration wedges are rubber elements that dampen the vibrations and impacts that occur in the mechanisms they are connected to and prevent their transmission and at the same time reduce the noise. The vibration wedge absorbs axial and radial forces. Vibration wedges protect the mechanism and its elements and ensure their longevity with these duties. An example of a vibration wedge is shown in Figure 2 [4].

Figure 2. Vibration Wedge [4]

Vibration wedges are rubber elements that dampen the vibrations and impacts that occur in the mechanisms they are connected to and prevent their transmission and at the same time reduce the noise. Vibration wedges absorb unwanted vibration forces. Vibration wedges protect the mechanism and its elements and ensure their longevity with these duties. In this way, they protect the mechanism in which they are used, ensuring their longevity.

A number of calculations are required to determine which vibration mount to use in a vibratory system. First of all, the operating speed of the system should be determined. After determining the operating speed, the "Transmission Ratio" of the vibration to the system body is accepted as the limit 10% [5] and wn (natural frequency of the system) is calculated in accordance with the Equation 1. Care is taken to ensure that the w/wn value is not a multiple of √2 in order to prevent the system from resonating [6]. After the wn value is determined, the Equation 2 is applied [6].

$$\text{Transmission Ratio} \rightarrow \beta = \left| \frac{1}{1 - \left(\frac{\omega}{\omega_n}\right)^2} \right| \quad (1)$$

$$\omega_n = \left(\frac{k}{m}\right)^{1/2} \quad (2)$$

While the m in this formula represents the total mass of the system, the value of k represents the spring strength which is considered sufficient for the system. After determining the spring strength, calculation is made according to the number of vibration wedges to be used in the system (For example, k/3 value should be used for 3 vibration wedges). While this value of k indicates whether the vibration wedge can dampen or not, it is important that these vibration wedges can carry the system. In this context, the weight of the load to be mounted on the vibration wedge should be calculated (Mass x Gravitational Acceleration) and the amount of load that this vibration wedge can carry should be checked.

Conclusion

We can decide which chock should be used in a system that has problems due to vibration as follows. At first, we have to determine the operating speed of the system and then we should find the natural frequency of the system by accepting the transmission rate of this system as 10%. In order to check the accuracy of the result found, we should check that the working speed/natural frequency ratio is not √2. We can determine the spring strength that is suitable for the found natural frequency. We list the vibration wedges with detected spring strength, examine their carrying capacities and decide on the vibration wedge required for the system.

References

1. https://tr.wikipedia.org/wiki/Titre%C5%9Fim
2. Saraf, S. R., & Holmukhe, R. M. (2011). Microcontroller based data acquisition system for electrical motor vibrations using VB software. Indian Journal of Computer Science and Engineering (IJCSE), 2(5), 727-737
3. https://www.eymenpetrokimya.com.tr/kaucuk-nedir-kaucuk-ne-ise-yarar/
4. https://tr.rsdelivers.com/product/fibet/2515vv18-45/fibet-2515vv18-45-titresim-takozu-m6-yuk-45kg-3mm/2983020
5. Rao, S. S. (2011). Mechanical vibrations. Prentice Hall, 5th edition. ISBN 978-0-13-212819-3
6. Steidel, R. F. (1979). An introduction to mechanical vibrations.