IOSR Journal of Engineering (IOSR JEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 01-03

Cost Effective Vibration Recording Instrument

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Abstract: *Now a days, vibration measurement is important because development of proper vibration isolation system is not possible if we don't know the actual cause of vibration. Some instruments are already available in market but these instruments are having high cost. In the present work, it is aimed to develop a vibration recording instrument that will give better accuracy at a reasonable cost.*

Keywords -*vibration measuring instrument, optical recording instrument, light sensitized paper, etc.*

I. Introduction

When any elastic body such as spring, shaft or beam is displaced from its equilibrium position by the application of external force and then released, it commences cyclic motion. Such a cyclic motion of body or a system due to elastic deformation under the action external force is known as vibration. All bodies possessing mass and elasticity are capable of vibration. There are two sides of vibration. All musical instruments works on the phenomenon of vibration, conveyors, shakers, vibrating screens works on the principle of vibration and also in stress relieving equipments vibrations are useful, these are the good sides of vibration. But on the other hand, vibrations causes excessive stresses in machine parts, it may lead to loosening of assembled parts and also it may lead to partial or complete failure of the machine, these are the bad sides of vibration.

1.1 Causes of Vibration

There are some causes of vibrations in machines like unbalance forces and couples in the machine parts, External excitation force applied on the machine, Dry friction between two mating surfaces, etc.

1.2 Need of vibration measurement

The measurement of vibration becomes necessary due to: the measurement of natural frequencies of machine or structure, which is vibrating is useful for selecting the operational speeds of the machine, because operational speeds are selected such that they should be far off from the natural frequency so as to avoid resonance. In design and development of vibration isolation system, it is necessary to know the frequencies of the vibration and the force developed due to vibration. To know the actual values of vibration characteristics of the machine or structure vibration measurement is necessary, This is because, the theoretically calculated values may be different from the actual values due to assumptions made in the analysis.

1.3 Problem statement

Number of instruments are available for measurement of vibration like FFT analyser, stylus recording instrument, seismic instrument, simple potentiometer and capacitance pick up. The stylus recording instrument gives less accuracy due to elasticity and mass of the linkages. Seismic instrument gives good accuracy but it is costly. Basically in the market FFT analyser is used for the measurement of vibration it gives better accuracy but its cost is very high. It can be used in cases, where the high accuracy is required.

1.3 Objective

The main objective of this project is to develop a vibration measuring instrument that gives better accuracy at a reasonable cost.

II. Literature Survey

Sudhakar. I et al., has represented that, Energy conversion is one of the inevitable parts of any industries. It involves either conversion of mechanical energy in to electrical or vice versa. The later conversion of energy. Statistics reveals, about 8 % of industries annual turnover met on maintenance. Thus substantial numbers of efforts are required to minimize in curing expenditure met towards break down maintenance. Condition monitoring is one of such techniques based on vibration widely used to recognize premature failures and a way to minimize cumbersome involved during breakdown of machinery. The present investigation involves a case study of squirrel cage induction motor has been chosen for the conditional monitoring to predict its soundness on the basis of results of FFT analyser. Thus the intended investigation deals with prediction of failure of 3-Ø Induction motor by analyzing the vibration spectral envelopes or signatures and time wave forms obtained by FFT Analyzer. Accelerometer was used to measures the acceleration which in turn is converted into impulses by the FFT analyzer to produce the vibration spectrums and time wave forms. Principle of vibrations

excitation was used as underlying principle for diagnosis of induction motor. The time wave forms and envelope spectra are recorded at different positions (radial and axial) using accelerometer and FFT analyzer under different loads (no load and full load) at non drive and drive end.[1]*Chengwei Li et al.,* has represented in the paper that, Selfmixing interferometry is an emerging and promising optical measurement technology. When a portion of the laser output light is reflected or scattered by the vibrating target and returned to the laser cavity. The output light and returned light form the optical feedback effect, which changes the output power and frequency of the laser. Laser output power changes an interference fringe when the external target moves by half a wavelength. To improve the accuracy of measurement, many signal processing algorithms have been propose, such as the phase unwrapping algorithm and the fourier analysis algorithm these algorithms can improve accuracy. When SMI occurs in a symmetrical cavity the light and vibrating target are not strictly vertical. The light will experience multiple reflections between the vibrating target and the laser. In such case, the number of interference fringes doubles or even increases three or four times. This phenomenon is called multiple selfmixinginterferometry. The phenomenon of double interference fringes could be produced through be a symmetrical cavity of a laser.[2]*Dr.Kalpande S. D. et. al***,**has represented performance improvement in reed type frequency meter. He focusses on selection of suitable material for the reed type frequency meter in order to enhance performance and to increase the production rate of the meter. While selecting the best suitable material the aim is to satisfy all the design and fuctional requirements thoroughly such as accuracy class and higher amplitude of vibration, clear visibility etc. by selecting the proper material for reed the performance and life reed frequency meters will be drastically improved and in future it is possible to produce the meters without calibration which is one of the time consuming but essential process.[3]

III. Components

1. Supply roll and take-up roll.
2. Drive Motor
3. Light sensitized paper.
4. Light Source with reflector.
5. Focusing lens
6. Flat Mirror
7. Belt drive

IV. Construction

Itconsist of bed on which supply roll, take up roll, hemicylindrical drum, electric motor and light source with reflector are mounted. Electric motor is connected to supply roll by using timing belt drives. Supply roll and take up roll are connected to each other by using timing belt drive. Timing belt drive consist of toothed pulleys of same diameter and toothed belt. The sensitized paper wound on supply roll and goes towards take up roll. It also consist of light source, lens and mirror. The mirror is connected to the body whose vibration is to be measured.

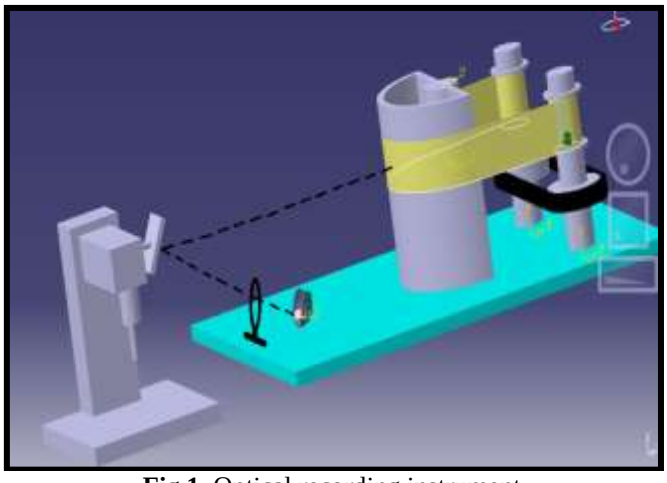

Fig.1. Optical recording instrument

V. Working

In optical recording instrument, the light source sends the light signal through a lens to a mirror. The mirror is attached to a vibrating body by means of some linkage. The light which is reflected from the mirror falls on a sensitized film on the hemicylindrical drum and plots the displacement of vibratory motion.The

sensitized paper is wounded on supply roll, it passes over the hemicylindrical drum and goes to the take up roll. The hemicylindrical drum has glass like finish. The supply roll and take-up roll revolves along the axis of shaft by means of an electric motor. We have maintained speed of supply roll and take up roll constant by using proper timing belt so that paper is in proper tension.

VI. Conclusion

Since the use of linkages is avoided,, the optical recording instrument will give amplitude of vibration with high accuracy. Once the amplitude of vibration is known, we can find all the other characteristics of vibrations.

Conflict of interest The authors declare that there is no conflict of interests regarding the publication of this paper.

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