Rotating unbalance report samples

[Psychology](), [Success]()

Abstract

Presented in this report are the results and the discussion of results for static and dynamic balancing. Static and dynamic balancing of rotating element in a machine is very important. The report has shown that the disks may be statically balanced but dynamically unbalanced. In the second part of this experiment, the arrangement required to balance the rotating shaft dynamically was obtained. The observations and results obtained in this experiment were consistent with our expectations. The second part of the experiment-involved determination of parameters needed to balance shaft and dynamically. The parameters determined in this case in order to balance the shaft dynamically are d4, d3, θ3 and θ4. From the vector diagrams these values were determined as d4= 135. 21 mm, d3= 23 mm, θ3= 1940 and θ4= 2590. The experiment was very successful.

Objectives

The objectives of this experiment are as follows:

Introduction

Static and dynamic balancing of rotating machine elements is a very important aspect of engineering design. The effect of the rotating elements if not well observed during the design stage may lower the safety of the machine. This is because the rotating elements generate a centrifugal force and vibration within the machine. The centrifugal force generates twisting moments on the support elements such as bearings. This undermines the overall performance of the machine. In addition, the vibration emanating from the rotating elements weakens most of the joined connections and cause fatigue failures in the various machine elements. The effects of the generated vibrations are more pronounced, especially when the generated vibration frequencies approach the natural vibrations of the body, resulting in resonance. At the vibrations amplitudes become high. Thus, engineers must ensure that they balance all rotating elements are statically and dynamically. This is the case with the crankshaft where engineers add additional counterweights to balance the crankshaft dynamically and statically. Motivated by this consideration the main objective of this report is to demonstrate the characteristic of static and dynamic balancing.

Background and theory

Figure 1 shows an eccentric mass, m, located at a radius, r from the centroidal axis. The mass will generate a centrifugal force, F= mrω2, when rotating at a speed ω rad/sec. The force will in turn generate a moment, M= Fd= mrdω2 about a bearing a distance d. It is important to note that the shaft may carry multiple eccentric masses.

When the shaft is statically balanced, only

F= 0.

In this case, the shaft will be balanced when statically but it might shake when rotating. On the other hand, when the shaft is dynamically balanced the shaft is balanced when stationary and when rotating. F= 0 and M= 0.

Figure 1: Rotating mass

Methodology

The following apparatus was used in this experiment:

- Static and dynamic balancing machine
- Weights

Procedure

Part 1

The character of static and dynamic balancing was observed from the machine. All the disks were removed from the blocks. Each disk had a number that corresponded to a particular block. The configuration of the equipment was set-up as shown in diagrams a, b, c and d in Fig. 2. The behavior at each configuration was observed when the shaft was non-rotating and rotating. The observations and discussions made herein are presented in the discussion section.

Figure 2: Shaft configurations

Observations

The observations made in the various configurations are shown in Table 1.

Methodology: Part 2

This part involved the determination of the arrangement required to balance a rotating shaft dynamically. The disks were put in their respective blocks, and appropriate 'Mr' values obtained for each block/disk by using a pulley and weights (Metal balls). The number of metal balls gave the 'Mr' values. The information for block 1 and blocks 2 are given in the table below.

The main task involved in this section is to determine The missing values in Table 2, these are d4, d3, θ3 and θ4. These were done by using the principlesF= 0 and M= 0. The values were obtained graphically by:

- Drawing to scale a vector diagram for 'Mr' values
- Drawing to scale a vector diagram for 'Mrd' values

Solutions

Vector diagram for 'Mr' values

Vector diagram for 'Mr' values was drawn in AUTOCAD 2012 as shown in figure 3 below:

Figure : vector diagram for 'mr' values

θ3 = 360 -166= 1940 And

θ4= 360-101= 2590

Vector diagram for 'Mrd' values

The vector diagram for 'Mrd' values have been drawn in AutoCAD at a scale of 1: 100 as shown in figure 4 below:

Figure 4: Mrd values vector diagram

m3 r3 d 3= 5. 05 *100 = 505

m3 r3= 22

22 d 3 = 505

d 3 = 505/22= 22. 95 ~23 mm

Also

m4 r4 d 4= 25. 69 *100 = 2569

m4 r4 = 19

19d 4 = 2569

d 4 = 2569/19= 135. 21 mm

Discussion

The first part of this experiment has shown that for static balancing the upward forces must be equal to downward forces. That is F= 0. The experimental observations in Table 1 clearly demonstrate that in static balancing F= 0. The observations in Table 1 also demonstrate the fact that a shaft may be statically balanced and dynamically unbalanced. This is the case with the first configuration where the shaft is statically balanced, but dynamically unbalanced. Thus, engineers must ensure that they achieve static and dynamic balancing of rotating machine elements. From the experiment, enormous vibrations and noise were noted when the shaft was dynamically unbalanced. These vibrations are very dangerous to the machine framework as it had been aforementioned. However, when the shaft was dynamically balanced, the noise and vibrations were absent.

The second part of this experiment clearly demonstrates the application of vector diagrams in order to determine the arrangement required to balance rotating shaft dynamically. The parameters determined in this case in order to balance the shaft dynamically are d4, d3, θ3 and θ4. From the vector diagrams these values were determined as d4= 135. 21 mm, d3= 23 mm, θ3= 1940 and θ4= 2590. This shows the importance of vector diagrams in determining the various unknown parameters needed to balance shaft both statically and dynamically. This is a very important aspect of engineering design where engineers must balance the shaft both statically and dynamically. For example, engineers incorporate additional counterweights when designing crankshafts in order to balance the crankshaft statically and dynamically.

Conclusion

References

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