

Designing and Fabrication of Rotating Fatigue Testing Machine by Varying The Speed And Load

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Abstract- Fatigue testing machine is used to determine the fatigue life or fatigue strength of a material. This failure begins with a small crack. The initial crack is so minute that it cannot be detected by naked eyes and is even quiet difficult to locate in x-ray inspection. This project is based on design and fabrication of a low cost simply supported loading rotating bending fatigue testing machine using locally sourced materials. Material selection is based on functionality, durability, cost and local availability. In this project we have calculated number of cycles by using tachometer at which specimen fails or crack. Specimen is subjected to repeated varying forces or fluctuation loading of specific magnitude. Many engineering machine and mechanical components are subjected to fluctuating stresses, taking place at relatively high frequencies and under failure is found to occur. "This is fatigue failure".

Keywords- Fluctuating stresses, fatigue failure, high frequencies, strength of materials, fatigue load.

I. INTRODUCTION

A fatigue is a failure of material or machine due to the action of repeated or fluctuating stress on a machine member for some number of times.

Eventually a crack will reach a critical size, the crack will expand at a faster rate, and the structure will fail. Fatigue failure generally involves three stages.

- a) Crack Initiation.
- b) Crack Propagation
- c) Final Fracture.

The crack will develop at a point of discontinuity in the material such as a change in cross section, a keyway, a hole or a notch. Less obvious points at which fatigue failure are likely to begin are inspection or stamp internal cracks or even irregularities caused by machining.

Once a crack is initiated the stress concentration effect becomes greater and the crack progresses more rapidly. As the stressed area decreases in size, the stress increases in

magnitude until finally, the remaining area fails suddenly. A fatigue failure therefore is characterized by two distinct regions. The first of those is due to the progressive development of crack, while the second is due to sudden fracture.

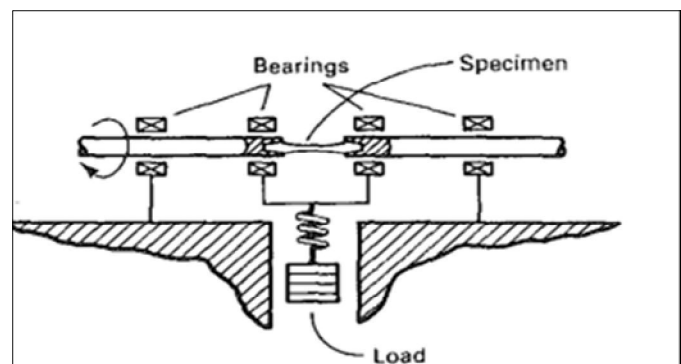


Figure 1. Fatigue testing m/c

II. LITERARURE SURVEY

B. I. Stoychev et.al [1] a unique fatigue testing machine was created for rotating bending with constant torsion that is multi-axial non-proportional loading. The machine is based on a statically indeterminate shaft system and thus no working power is consumed but only power on dissipation. Another more idea for technical equipment for bending with torsion, the idea of inversion, was implemented: the specimen is immovable but the (plane of) bending is rotated.

Andre Carvalho et.al [2] Endodontic rotary file instruments used to treat root canals in dentistry suffered breakthrough transformations in recent years when stainless steel was replaced by Nickel-Titanium (NiTi). NiTi alloys used in Endodontic possess super elastic properties at body temperature (37C) that bring many advantages on the overall performance of the root-canal treatment. They can follow curved root canals more easily than stainless steel instruments and have been reported to be more effective in the removal of the inflamed pulp tissue and protection of the tooth structure.

Sameer Mhatre et.al [3] Engineering machines and mechanical components are subjected to fluctuating stresses,

due to which the failure of component occur below the ultimate tensile strength. This type of failure is called fatigue failure. The machine used for this purpose is fatigue testing machine. This paper describes the design, fabrication of dual fatigue testing machine. This work was undertaken considering the high cost of the presently available fatigue testing machines to design this fatigue testing machine. Specimens are subjected to repeated fluctuating stresses and the no. Of cycles are counted till the breakage of specimen and the results are plotted.

III. SYSTEM DESCRIPTION

Components:

Shaft and specimen-

A high carbon alloy steel that is EN8 was selected as material for shaft. The machine design use two shafts; shaft and specimen. The principal function of the shaft is to rotate the specimen while it is under the action of bending moments from the dead weights hanged to overhang bearings. Specimen made up of mild steel is used.

Jaw coupling –

Jaw coupling made up of grey cast iron is used to transmit power from motor shaft to the shaft. Jaw coupling is used because the spider allows the angular misalignment if any and adjust accordingly.



Figure 2. jaw coupling

Pedestal bearing –

The bearings selected for the design were self-aligning roller bearings, which have high load carrying capacity and it can accommodate misalignment and shaft deflections maximum of 0.5° . It consists of cast iron pedestal,

phosphor bronze bushes or steps made in two halves and cast iron cap..

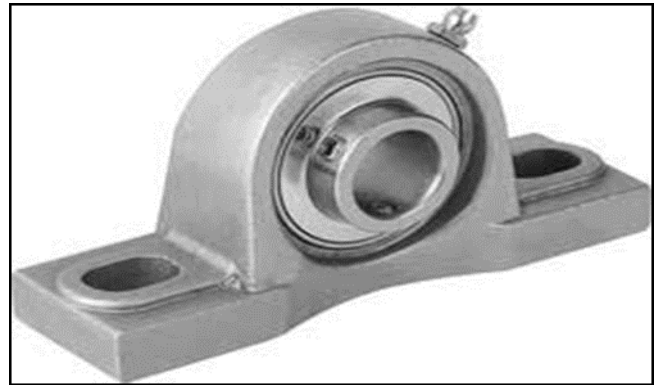


Figure 3. Pedestal bearing

Drill chucks

A three jaw drill chuck with taper fittings was selected as the specimen clamp for the fatigue machine.. The specimen must not rotate from the grip or be displaced vertically or horizontally.



Figure 4. Drill Chuck

Electric motor

One of the most common electrical motor used in most applications which is known as induction motor. This motor is also called as asynchronous motor because it runs at a speed less than its synchronous speed.

Power 60 W
Size 200-19mm
Speed (RPM) 1350 RPM
Voltage 230 V

Features:

- Low noise

- High operational efficiency
- Easy and smooth functionality
- Specification:
- Material: Iron, Copper, and Aluminum
- Current: 70 Amp
- Frequency: 50 Ac Hz



Figure 5. Electric Motor

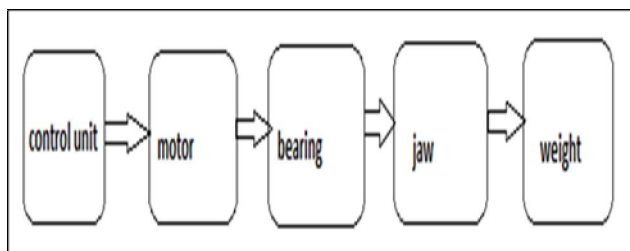


Figure 6. Block Diagram

IV. WORKING PRINCLPLE

- The fatigue-testing machine is of the rotating beam type.
- Control unit is used to rpm varying.
- The shaft is to rotate the specimen while it is under the action of bending moments from the dead weights hanged to overhang bearings.
- Jaw is used to transmit power from motor shaft to the shaft.
- Then weight hanger arrangement is used to apply load on overhang bearings.
- And improvement can be done by varying speeds and varying loads.

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