

# Review Paper on Durability Testing of Spring By using Cam Mechanism

<sup>#1</sup>Supriya Kadam, <sup>#2</sup>Shubham Kucheriya, <sup>#3</sup>Siddharth valsange,  
<sup>#4</sup>Pranav Panhale



<sup>1</sup>supriyakadam1195@gmail.com  
<sup>2</sup>Shubhamkucheriya21@gmail.com  
<sup>3</sup>siddharthvalsange@gmail.com  
<sup>4</sup>panhalepranavs15@gmail.com

<sup>#1234</sup>Department of Mechanical Engineering

P K Technical Campus, Chakan, Pune, Maharashtra, India

## ABSTRACT

**This paper represents a comparative study of durability testing of springs. Durability testing machine is use to check the durability of springs. The springs which are used in car head assembly, engine-valve, ball pens etc are tested by durability testing machine. Testing machines which are use in large scale industries are costlier one, cost of such testing machine is not affordable for small scale industries, small workshops etc. So our main aim is to create a durability testing machine by using simple cam mechanism in a low cost suitable for small industries. By using cam mechanism, we apply cyclic load on compression springs unless it loses its elastic properties. and counts the number of cycles by using counter and proximity sensor.**

**Keywords: Springs, Durability, Cam Mechanism, Cyclic Loading.**

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## I. INTRODUCTION

Spring is defined as the elastic element used to stored mechanical energy. The durability of a spring is measured by its ability to not lose force, or shorten under a given force when subjected to spring travel. If a spring is to be durable, the stress in the material must not be greater than the strength of the material permits. When a load is applied to a piece of metal, it must deflect first elastically, and if the load is high enough, it will also do this plastically. Elastic deflection is when the material returns to its previous shape after unloading. During plastic deflection, the metal receives a permanent deformation and cannot return to its previous shape after unloading. This is why it is the elastic part of the deflection which is used to receive the deflection in durable springs.

The demand for the present day machine components to move in a prescribed exact path is rarely fulfilled by connected members. Therefore, it is necessary to make use of the miscellaneous contour surface called "Cams". They play a vital role in almost all machines e.g. textile machine tools I.C. engines, printing etc. A cam may be defined as a mechanical element used to drive another element, called the follower through a specified motion by direct contact. Cam and follower mechanisms are simple and in expensive, have few moving parts and occupy a very small space.

Furthermore follower motion having almost and desired characteristics modern machinery.

Usually a cam mechanism is a single degree of freedom device. It is a case of higher pair with line contact. The demands for more accurate cam profile manufacturing have resulted in many performance testing devices.

The main objective of the project is,

1. To check the durability of spring this is located in the car. It is situated in seat assembly of car.
2. Accurate checking of the durability of the spring of nearly about 6000 cycles.

## II. PROBLEM STATEMENT

In car seat head rest assembly spring is used for more comfortness. Therefore in large scale industries it was necessary to check the durability of the spring for 6000 cycle. Previously this was done manually, by the worker which had following drawbacks:

- The process was time consuming which lead to pending of the work.
- Due to repetition of the work, the process caused boredom and fatigue to the worker.

- It was difficult to apply consistent force for all the cycle manually.
- It caused imperfect inspection due to human limitation, which lead to selection of defective part.
- To eliminate above limitation of manual testing it was necessary to develop mechanism.

### III. OBJECTIVE

Our main objective is to reduce the inspection time and to get accurate result, we are developing the cam mechanism. The main consideration is to reduce the inspection time and to get accurate result. Automation is done to reduce the manual work. Also the development of the mechanism has to be cost effective.

After the observation of the component to be test the main focus is on to which type of mechanism should be used to apply force on to the spring. The idea is to hold the job in the clamping device and to apply the force by the cam mechanism.

For counting the number of cycle we use a capacitive proximity sensor with a relay and a counter to get digital reading.

### IV.SCOPE

The main requirement of the mechanism is to test the component and to measure for long-term performance capacity of component. Durability testing is an essential step to predicting the life of components. It also help to reduce risk of selecting defective parts or components.

It provides:

- Accurate checking of the durability of the spring.
- Eliminate human error.
- Increase productivity.
- Reduce the checking cost and time.
- Proper and accurate operation.
- It apply similar force for all cycle.

### V. METHODOLOGY

Firstly the motor is mounted on the base. belt and pulley drive is use to rotate the shaft. Belt and pulley drive is driven by motor. Transfer the rotary motion of the motor to the shaft with the help of belt and pulley drive mechanism. Two bearing are used to support the shaft on which the cam is fitted. Screw is used to fit the cam on the shaft. Clamping device is fitted below the cam which is used to hold the job throughout the process. A capacitive proximity sensor is fitted on the side of the cam for counting process. Relay is used to stop the motor after 6000 cycle. Counter is used for counting the no. of cycles completed.

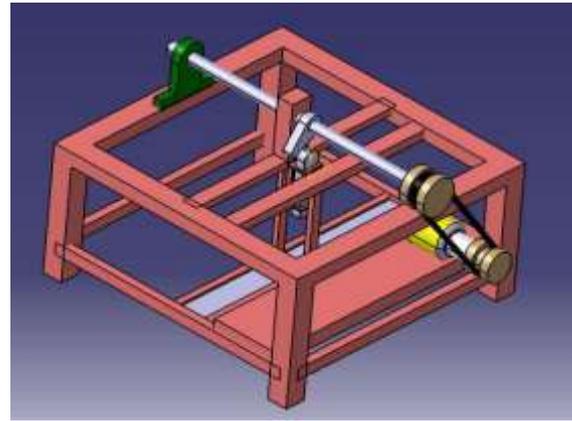


Fig.1-experimental set-up

### VI. LITERATURE REVIEW

The result of very high cycle fatigue tests on helical compression spring which respond to external compressive force with torsional stress is presented in this paper. in this paper, in that fatigue test , fatigue load is applied on the shot- peened helical compression springs made of si-cr-alloyed valve spring wires with wire diameters of 3mm and 5mm. fatigue load is nothing but fluctuating load or intensity of load is different. in that paper , it is presented that when there is an increase of cycle from  $10^7$  to approximately  $10^8$  cycles results in a nearly 10% reduction of the fatigue limit for 90% survival probability, while an increase from  $10^7$  cycles to  $1.2 \times 10^9$  cycles reduces the fatigue limit for 90% survival probability by approximately 25%[1].

To find out the stiffness of spring by using testing machine which works on hydraulic system is presented in this paper for automotive springs the most relevant performance characteristics is stiffness. The stiffness is nothing but the extent to which it resists deformation in response to an applied force. In this research paper the stiffness of coil spring is calculated by a typical performance test include applying a series of variable load to each spring literarily bouncing it up and down for a specified period of time at high rate of speed. The result are collected via a gauge and compared to an established performance design standard or master part for that specific spring type each part is either accepted or rejected based on this precise data analysis.[2]

One definition of reliability is “the measure of unanticipated interruptions during customer use.” The unanticipated interruptions typically arise from unexpected failures. During a reliability test, one important goal is to maximize the opportunities we have to observe unpredictable failures, the greater the chance that we are not testing to measure reliability. A test may appear to be a reliability test and actually be a durability type test when opportunities for discovering unscheduled interruptions are minimized unintentionally. In this paper,they first discuss the difference between reliability and durability.when we studied between the both of this, One measure of durability is represented by the duration of product ownership. Reliability, on the other hand, represents interruptions in usage during that

ownership. The ownership of any product or system cannot be enjoyed if it is continually interrupted and desired functions lost for even a brief time. This means reliability takes precedence over durability even though both are desired in most applications. To assess reliability or durability we rely on internal qualification tests, because it is not possible to calculate either reliability or durability from basic principles alone. Even if we can generate mathematical models to estimate reliability or durability, the modes still need to be verified by testing.[3]

This work presents a complete and systematic method for the analysis and simulation of geometric characteristics of mating surfaces of globoidal cam mechanisms. Based on the fundamental forms of globoidal cam surface, the asymptotic curves, the principal directions and curvatures, and the Dupin's indicatrix are obtained and simulated. The curvatures of asymptotic curves are calculated to verify whether the cam surface is a ruled surface or not, which is an important issue to determine the machining process of the globoidal cam. In addition, the relationship between the local shapes of the cam surface and the motion periods is presented. The characteristic curves of relative normal curvature at different contact points are depicted and compared as well. Based on the Dupin's indicatrix, the indicatrix of conformity (Dr. Radzevich, 1980s) is first applied to analyze the contact geometry of mating surfaces of globoidal cam mechanism. The indicatrix of conformity in the case of contact of saddle-like surface with convex parabolic-like surface is first discussed here. A globoidal cam mechanism used in automatic tool changer of CNC machines is presented to clarify the outlined methods. The proposed methodology is important for design, manufacture, and contact analysis of globoidal cam mechanism.[4]

In this paper, we have studied the durability and reliability of leaf spring. Durability of leaf spring is measured by using cam and follower mechanism. Design the leaf spring as a composite leaf spring. It is an automotive component which is used to absorb vibrations induced during the motion of vehicle. Leaf springs are long and narrow plates attached to the frame of a trailer that rest above the trailer's axle. The load on the leaf spring acts on the center. The spring thus vibrates and prevents the vibrations to pass over to the other parts. There are single leaf springs and multi leaf spring used based on the application required. It also acts as a structure to support vertical loading due to the weight of the vehicle and payload. The Glass fiber reinforced plastics (FRP) composite mono leaf spring reduces weight of the machine element without any reduction of the load carrying capacity. It has high strength-to weight ratio compared with those of steel. Also multi-leaf steel springs are being replaced by mono leaf FRP spring. The objective of this project work is to design and manufacturing of composite leaf spring. The experimentation is conducted for durability and results are compared with steel leaf spring.[5]

## VII. CONCLUSION

The development of the Cam mechanism for durability testing of the spring used in the many assemblies. It called

for the application of various concepts of engineering. The mechanism was developed and manufactured effectively by us. We arrangement and manufacturing of the mechanism improve the performance and it was found to give fairly accurate results, thereby eliminating the drawbacks encountered with manual testing process. It therefore can be asserted that the final spring will be permanent in meeting the standard performance and assure reliability and satisfaction to the customer.

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