

Design & Analysis of Helical Spring Testing Machine: A Review

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Abstract— Spring is an essential component used in many engineering's and mechanisms for proper functioning of that machine for maximum efficiency, applications for which springs are used are automobile suspension, IC engine valves, measurements of weights, for energy storage, two wheelers, brakes, clutches, shock absorber, etc.. But sometimes spring used in above applications leads to number of flaws such as manufacturing flaws, processing flaws like defects occurs at the time of hardening sometimes this causes more hardened spring which has more stiffness value and sometimes causes a less stiffness value hence creating a problems while used for spring applications and also creates a problems in working of that machine components. For bringing the new ideas and concepts to the life engineer has to be focused. Therefore, for economical manufacturing of products modern techniques has to be constantly invented and implemented. At the same speed, time, quality and accuracy factor are also considered. In the proposed project we are performing design and analysis of helical spring testing machine. The design and analysis of helical spring testing machine will be used to test the parameters such as the value of force needed for predetermined displacement of spring, the value of displacement induced for predetermined force applied on spring and to hold the compressed spring for a specified duration of time to see if it regains its original length after the removal of force. The design of spring testing machine based on the specification and data provided by the company.

Key words: Spring Testing Machine

I. INTRODUCTION

A spring is mechanical devices which is defined as elastic machine element, which will be deflect under the action of the external force and regain its original shape when external forces are removed. The main parameter in spring design is Spring Stiffness and spring index. Spring stiffness is defined as the external force applied per unit deflection.

Mechanical springs are one of the components which need to be tested before its final assembly. For any type of spring the most important factor is its stiffness value which differs according to its application? Springs are basically an elastic body which reacts according to the load applied i.e. tension or compression. Its purpose is to distort under load and absorb or release energy rapidly according it the respective condition. For helical springs the stiffness is calculated by applying a series of external loads to the individual springs respectively, literally bouncing it up and down at the high rate of speed for specific duration of time. These parameters are considered while testing springs. Rapid to and fro motion which produces vibrations leading to produce frequency is the principle used in designing and developing of this spring testing machine.

Springs of various sizes and shapes such as Tension helical spring, Compression helical spring, and Leaf spring are designed and manufactured. For measuring their stiffness

value it is very lengthy and difficult, if we have such proper tools. Stiffness measuring machine is useful for spring manufacture and spring purchasers for measuring the stiffness value of the spring.

Today world technology advances and goes beyond the expectations and perception of simple persons... Mechanical system is transforming to combinations mechanical and electronic system called mechatronics system, hence more precision and accuracy is needed. According to the requirements of market we can design and analyses the spring testing machine for improving its performance.

II. LITERATURE REVIEW

Avdhut R Jadhav, Gajendra J Pol, Amit A Desai [1] In this paper the industries for making the hydraulic valves purchase the springs but they face the problem of measuring the stiffness value of the spring. After studying and understanding this problem industry developed hydraulic spring stiffness testing machine for calculating the stiffness valve. They have calculate the spring stiffness only by considering two parameters that is load and deflection.

S.S.Joshi, S.S.Jangali, D.S.Joshi, S.M.More [2] In this paper the working of hydraulic stiffness testing machine they developed is based on Pascal's law which states that "Pressure Applied at Any Point on Any Confined Liquid Is Transmitted Equally to All Other Points" They calculate stiffness of spring with the help of force and deflection produced in the spring. By varying the force they obtain corresponding deflections. They studied the suspension characteristics of spring by graphical method.

In this project, pressure is applied on spring with the help of hydraulic system. Applied load and deflection produced in spring is measured by microprocessor and value of spring stiffness is displayed.

Nagre N.P., Bhosale M.S., Prof. Patil S.C [3] The main objectives of this project are designing and constructing a spring stiffness test rig that is capable of testing a various types of springs of different height, diameters and of materials, reduce the time required for testing and increase the profit of small scale industries, reduce inventory, investment cost, and low initial cost of machine and it should be easily operated.

The hydraulic spring stiffness testing machine was designed is cheap as compare to digital stiffness testing machine. Hence this machine, it can be used in garages and small industries. It is easily manufacture in workshop.

Ashfaq J., Basit Ali, Musawwir F., Huzaifa K. and AafaqG.[4] In this paper they have developed a machine that is used for calculating the stiffness of the spring for the various spiral and helical springs in the limit range of 40mm to 60mm. which are used in the garages where the inspection of the of suspensions of various automobiles is takes place. And hence with help of this machine they are analyzing the

condition of the suspensions by comparing the stiffness valve of the spring of testing one with the standard one. The working of machine is simple the pressure is applied through the hydraulic jack or compressor (according to the compressive strength of the spring that is to be tested) the spring that is mounted on the testing table is compressed. The spring will oppose the pressure of the fluid and calculating or recording this resistance of the spring will in turn gives its stiffness.

ChandgudeViresh V, ChattarNilesh G, ChaudhariSharad B, Gaikwad Vicky B, BhaneAjit[5] In this paper the stiffness testing machine setup was designed to optimizes the conventional type of setup to modern type of setup by using the LM (linear motion) guide which reduces the friction and also helps to gives the accurate results hence by using LM guide performance of this machine was improved and this machine reduces the time of testing and ultimately it supports to reduces the cost of the testing. It can be test the spring of minimum height of 50 mm also. This machine is very accurate and precise in nature.

PathanMosinAouraze, Patel SoyalDastagir, PawarSantoshBalu, LabadeSuyogBajirao [6] in this paper we see how the stiffness is measure. For this they use spring stiffness testing machine to compress the spring and measure the corresponding load and deflection of spring. With the help of load and deflection reading they calculate the stiffness of spring. This machine can be used to find stiffness of spring having diameter ranges from 40mm to 70mm. The result obtained from this machine is verified with standard value. This machine is able to make testing of spring stiffness easier and affordable by automobile industries.

III. IDENTIFIED GAPS IN THE LITERATURE

Many researchers have presented their work on development and optimization of hydraulic spring stiffness testing machine considering limited parameters, calculations on stiffness of spring .Comparison of digital stiffness testing machine and hydraulic stiffness testing machine, methods to calculate the stiffness was also observed during our study. Very limited and small amount of work for design and analysis has been observed and there is still a need for further work. Understanding the problems this work is mainly focused on design and analysis of spring testing machine.

IV. PROBLEM FORMULATION

There are many companies which uses springs and springs are the important components in their machine in which they install it but main problem arises during testing the stiffness of spring. This project is based on the requirement of the Company. The company AI Engineering Enterprises provides leading-edge engineering and manufacturing solutions. It is required that company need to design a spring testing machine, according to the discussion with the company persons of the company. This spring testing will be used to test the parameters such as the value of force needed for predetermined displacement of spring, the value of displacement induced for predetermined force applied on spring and to hold the compressed spring for a specified duration of time to see if it regains its original length after the removal of force.

V. RESEARCH METHODOLOGY

The design and analysis of spring testing machine which will be used to test the parameters such as the value of force needed for predetermined displacement of spring, the value of displacement induced for predetermined force applied on spring and to hold the compressed spring for a specified duration of time to see if it regains its original length after the removal of force.

In this work all the essential Data will be accumulated, CAD model of the spring testing machine will be generated. FEA analysis and calculations will be performed .After that results will be discussed and design will be finalized. The design of spring testing machine is based on the specification and data provided by the company.

VI. CONCLUSION

Our project involves the design and analysis of spring testing machine. The detailed study of spring testing machine from the sources available has help us to gain deeper knowledge of spring parameters , spring stiffness , spring index , its working Principled. By performing design and analysis company will be directly benefited as the work will help them to test different spring parameters and help them to make improvement in their products.

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