" A SPRING FEA ANALYSIS FOR TRACTOR SEAT "

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ABSTRACT

In this project we are going to study helical springs and its specification. Helical springs are widely used in many engineering applications due to their importance. Helical compression springs are used widely all over the world. It has different type of applications in different area. Springs are used in mechanical equipment with moving parts, to absorb loads, which may be continuously, or abrupt varying. The absorption of the loads takes place in the form of elastic energy. The failure of tension spring is at the hook end and it is due to un uniform ness of material and due to heat treatment processes. Due to wavy loads there are sudden fractures. Due to excessive loading causes failure of tension springs. The FEA simulates the loading conditions of a design and determines the design response in those conditions. It can be used in new product design as well as in existing product refinement. A model is divided into a finite number of regions/divisions called elements. So, We are using FEA approach in order to optimize spring and its diemensions.

Keyword: - *Helical compression springs,FEA*

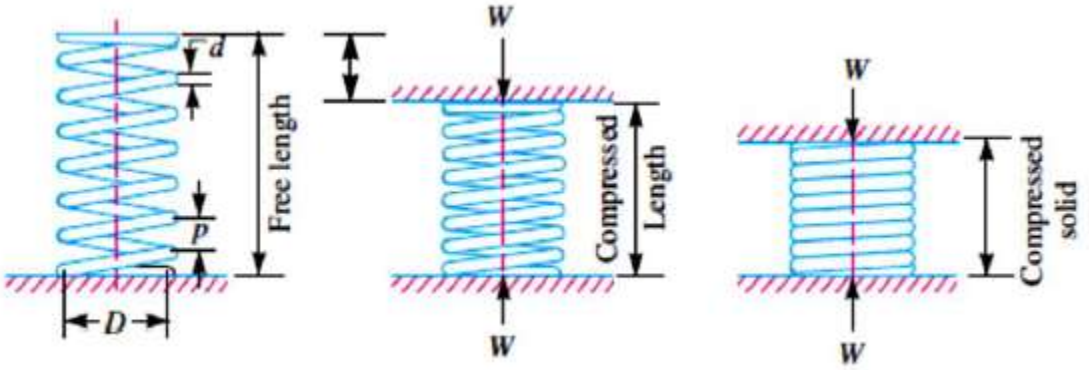
1. INTRODUCTION

Helical springs are widely used in many engineering applications due to their importance. Helical compression springs are used widely all over the world. It has different type of applications in different area Springs are used in mechanical equipment with moving parts, to absorb loads, which may be continuously, or abrupt varying. The absorption of the loads takes place in the form of elastic energy. Coil springs are manufactured from rods which are coiled in the form of a helix. The design parameters of a coil spring are the rod diameter, spring diameter and the number of coil turns per unit length. Compression springs may be cylindrical, conical, tapered, concave or convex in shape. Vehicle suspension system is made out of springs that have basic role in power transfer, vehicle motion and driving.

A spring is defined as an elastic body, whose function is to distort when loaded and to recover it original shape when the load is removed.

1.1 Terminology:

The definitions that follow are for terms which have evolved and are commonly used in the spring industry. Figure shows the relationships among the characteristics.



The outside diameter (OD) is specified when a spring operates in a cavity. The inside diameter is specified when the spring is to operate over a rod. The mean diameter D is either OD minus the wire size or ID plus the wire size.

The coil diameter increases when a spring is compressed. The increase, though small, must be considered whenever clearances could be a problem. The diameter increase is a function of the spring pitch and follows the equation.

1. Spring Index. Spring index C is the ratio of the mean diameter to the wire diameter (or to the radial dimension if the wire is rectangular). The preferred range of index is 5 to 9, but ranges as low as 3 and as high as 15 are commercially feasible. The very low indices are hard to produce and require special setup techniques. High indices are difficult to control and can lead to spring tangling.
2. Free Length. Free length Lf is the overall length measured parallel to the axis when the spring is in a free, or unloaded, state. If loads are not given, the free length should be specified. If they are given, then free length should be a reference dimension which can be varied to meet the load requirements.
3. Types of Ends. Four basic types of ends are used: closed (squared) ends, closed (squared) ends ground, plain ends, and plain ends ground. Illustrates the various end conditions. Closed and ground springs are normally supplied with a ground bearing surface of 270 to 330°.
4. Number of Coils. The number of coils is defined by either the total number of coils Nt or the number of active coils Na. The difference between Nt and Na equals the number of inactive coils, which are those end coils that do not deflect during service.
5. Solid Height. The solid height Ls is the length of the spring when it is loaded with enough force to close all the coils. For ground springs, Ls = Ntd. For unground springs, Ls = (Nt + 1)d.
6. Direction of the Helix. Springs can be made with the helix direction either right or left hand. Illustrates how to define the direction. Springs that are nested one inside the other should have opposite helix directions. If a spring is to be assembled onto a screw thread, the direction of the helix must be opposite to that of the thread.
7. Spring Rate. Spring rate k is the change in load per unit deflection.
8. Pitch. The pitch of the coil is defined as the axial distance between adjacent coils in uncompressed state.

1.2 Objectives of spring:

1. To provide Cushioning, to absorb, or to control the energy due to shock and vibration. Car springs or railway buffers to control energy, springs-supports and vibration dampers.
2. To Control motion .Maintaining contact between two elements (cam and its follower) Creation of the necessary pressure in a friction device (a brake or a clutch).
3. To Measure forces. Spring balances, gages.

4. To Storing of energy.
5. In clocks or starters .The clock has spiral type of spring which is wound to coil and then the stored energy helps gradual recoil of the spring when in operation. Nowadays we do not find much use of the winding clocks.

2.LITERATURE REVIEW

Supriya Rahul Burgul1, Atul.P.Kulkarni et al has states that for Fatigue Analysis (MSC Fatigue) since the spring are subjected to cyclic loading. The analysis established the expected life of the spring while it is subjected to the predetermined loads during its operation.To verify new design the Fatigue test experimentation is carried out on the fatigue test machine (Special Purpose Machine).[1]

Vikram Vakte, Firojkhan Pathan studied existing design of helical spring and manufacturing the spring and carry out the vibration analysis of helical spring for tractor seat to reduced vibration at the time of dynamic loading condition, applied on helical spring. At different load condition and vibration they check the failure analysis of spring. In general they studied vibration analysis of spring and also study the effect of varying the number of turns of the spring. In tractor seat vibration take place so they reduce this vibration by using suitable design and material.[2]

3.PROBLEM DEFINITION

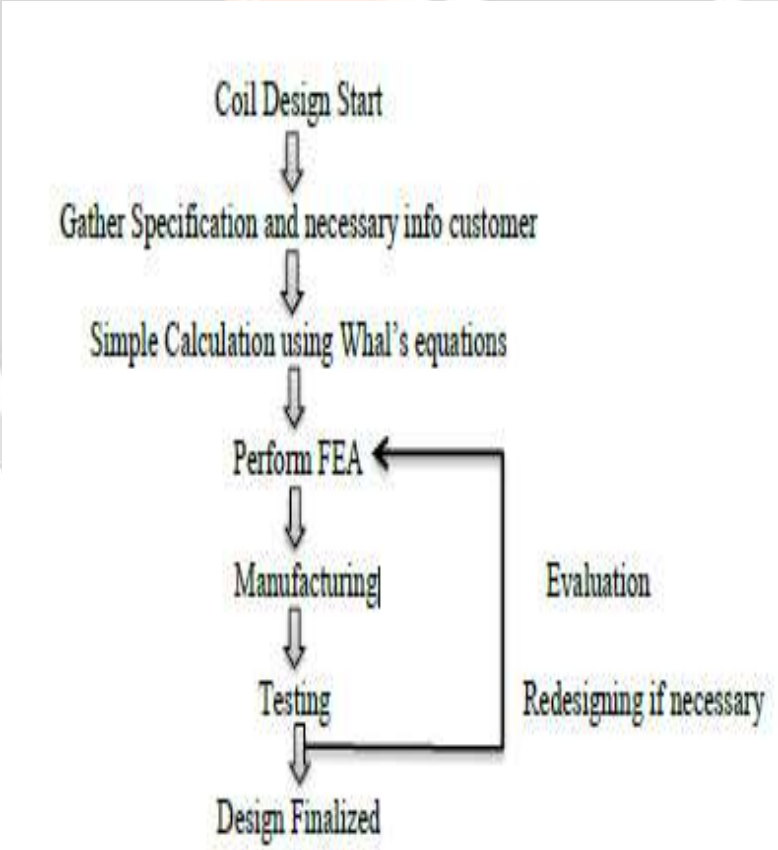
To find the problem of failure in tractor seat helical tension springs and try to replace it by helical compression springs using stress and fatigue analysis.

The failure of tension spring is at the hook end and it is due to un uniform ness of material and due to heat treatment processes. Due to wavy loads there are sudden fractures. Due to excessive loading causes failure of tension springs.

4. Objectives:

1. Study existing design of helical spring also its properties
2. Design and manufacturing the helical compression spring.
3. Carry out dimensional optimization the helical compression spring.
4. Carry out the fatigue life analysis and stress analysis of helical spring.
5. To study effect of different springs during analysis.

5. METHODOLOGY



6. Introduction to FEM

The FEA simulates the loading conditions of a design and determines the design response in those conditions. It can be used in new product design as well as in existing product refinement. A model is divided into a finite number of regions/divisions called elements. These elements can be of predefined shapes, such as triangular, quadrilateral, hexahedron, tetrahedron, and so on. The predefined shape of an element helps define the equations that describe how the element will respond to certain loads. The sum of the responses of all elements in a model gives the total response of the complete model.

7. REFERENCES

[1]. Supriya Rahul Burgul, "Fatigue Analysis for Helical Compression Spring for Determining Design Alternatives for Enhanced Life and Performance", International Journal for Technological Research in Engineering (IJTRE) Volume 2, Issue 7, March-2015
[2]. Vikram Vakte, "Simulation of Helical Spring Used In Tractor Seat Application", International Journal of Modern Trends in Engineering, 24 July 2015 1958–1962
[3]. Vikram Vakte, "Analysis and Comparison of Helical Spring Used in Tractor Seat Application", International Engineering Research Journal (2015) 4400–4403
[4]. Jinhee Lee, "Free Vibration Analysis of cylindrical helical spring By pseudo spectral method", „Journal of sound & Vibration", 2007, 302,185-196.
[5].A.M.YU,Y.Hao, " Free Vibration Analysis of cylindrical helical spring with non-circular cross section", „Journal of sound & Vibration",2011,330,2628-2639.
[6].Mohamed Taktak, "Dynamic optimization design of cylindrical helical spring". „Applied Acoustic", 2014, 77,178-183.
[7] .Aimin Yu. "Formulation and evaluation of an analytical study for cylindrical helical spring". „AMSS", 2010, 23, 0894-9166.
[8] Youli Zhu,Yanli Wang, "Failure analysis of a helical compression spring for a heavy vehicle"s suspension system", 2014, 2,169-173
[9].Y. Prawoto, M. Ikeda, S.K. Manville, A. Nishikawa,"Design and failure modes of automotive suspension springs." Engineering Failure Analysis 15 (2008) 1155–1174.
[10]. Reza Mirzaeifar, Reginald DesRoches "A combined analytical, numerical, and experimental study of shape-memory-alloy helical springs".„International Journal of Solids and Structures", 2011, 48,611-628.
[11].B. Pyttel, "Fatigue behavior of helical compression springs at very high number of cycles – Investigation of various influences", International Journal of Fatigue 60 (2014) 101-109
[14]. Design of machine Element, V.B. Bhandari, Edition 2001, Tata Mc Graw Hill.

8. BIOGRAPHIES

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