

# STATIC ANALYSIS OF HELICAL COMPRESSION SPRING

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## Abstract

A spring is a flexible element used to exert a force or a torque and, at the same time, to store the energy. The force can be a linear push or pull, or it can be radial, acting similarly to a rubber band around a roll of drawings. The spring which is considered in the paper is a part of automobile horn, where the horn is used for maintain safe distance and it is subjected to varying load. The spring is analyzed through analytical and finite element method to check the variation in the deformation value as well as maximum shear stress value. By the results of ANSYS it is observed that analytical results and finite element method results are within the acceptable range.

**Keywords:** Spring, Automobile Horn, Finite Element Method.

## 1. INTRODUCTION

A spring is defined as an elastic body, whose function is to compress when loaded and to recover its original shape when the load is removed. A spring is a flexible element used to exert a force or a torque and, at the same time, to store energy. The force can be a linear push or pull, or it can be radial. The torque can be used to cause a rotation. Springs can be classified according to the direction and the nature of the force exerted by the spring when it is deflected. Helical compression springs are typically made from round wire, wrapped into a straight, cylindrical form with a constant pitch between adjacent coils. Square or rectangular wire may also be used. Without an applied load, the spring's length is called the free length. When a compression force is applied, the coils are pressed more closely together until they all touch, at which time the length the minimum possible is called the solid length.

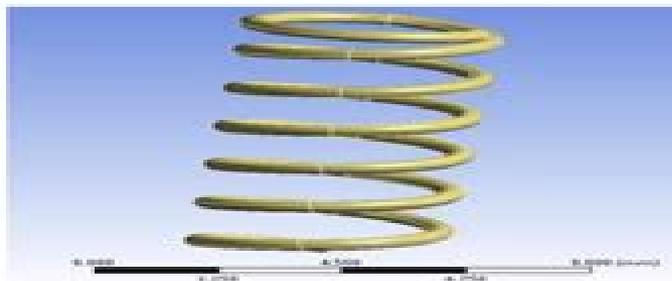


Fig –1: Model of spring

A static analysis is carried on helical compression spring which is used in two-wheeler horn by S.S.Gaikwad et.al[1], in his paper analytical results are compared with NASTRON software results. Varun B. and K. K. JAIN [2], they considered helical spring which is subjected heavy duty or load.

## Notations

D – Mean Diameter of Coil.  
 d – Diameter of Wire.  
 l – Total Length of Wire.  
 n – No. of active Coils.  
 $\tau$  – Maximum Shear Stress.  
 $\theta$  – Angular deflection of the Wire.  
 T – Twisting Moment.  
 J – Polar Moment of Inertia.  
 W – Load.  
 C – Spring Index.  
 $\Delta$  – Deflection of the Spring.  
 G – Modulus of Rigidity for the spring material.

## 2. ANALYTICAL METHOD

In design of helical spring, initially spring considered as per some dimensions like free length of spring, wire diameter, mean diameter of spring, pitch of spring this dimensions either as per calculation or as per application. But when it is subjected to load then spring will act according to load and get deformed or stressed so, it is important to know when spring is subjected to load what is the maximum deflection and maximum shear stress. Some other values are also considered but in this paper only deflection and maximum shear stress are considered because of application of spring needs these

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**Fatigue Analysis of a Helical Compression Spring** Gaikwad Sunil, 2015-01-23. The objective is to present experimentation, modeling and analysis of compression spring for static fatigue. Experimentation is carried out using load checking machine M006 for static analysis and for fatigue life analysis, fatigue testing machine M08 is used. Modeling is done using CATIA V5 and ANSYS. Analysis is carried out by using HYPERMESH as a pre processor, NASTRAN as a solver and Hyper view as a post processor. ANSYS14.0 software was also used for analysis for better understanding and comparison result with NASTRAN. From the study it is seen that the fatigue life of stainless steel compression spring is more as compared to that of hard drawn wire for same stiffness, same load carrying capacity. It is observed that the maximum stress is developed at the inner side of the spring coil. The NASTRAN and ANSYS allowable design stress is found between the corresponding loads 3 N to 6 N. Therefore it is concluded that the maximum safe pay load for the given specification of the helical compression spring is 4 N. A comparative study has been made of a redesign spring with respect to stress, fatigue life, safe pay load.

**Advances in Materials and Manufacturing Engineering** T. Rajmohan, K. Palanikumar, J. Paulo Davim, 2020-09-21. This book comprises selected papers from the Fourth International Conference on Materials and Manufacturing Engineering ICMME 2019. The contents focus on the latest developments in the synthesis and characterization of new materials and highlights the challenges involved in the manufacturing and machinability of different materials. Advanced and cost effective manufacturing processes and their applications are also discussed in the book. In addition it covers topics like robotics, fluid dynamics, design and development and different optimization techniques. The contents of this book will be beneficial to students, researchers and industry professionals.

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