# Analysis of helical compression spring used in two wheeler suspension system using Ansys software

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## Abstract

*The helical compression spring used in two wheelers is belonging to the medium segment of the Indian automotive market. The detailed assessment of the problem of two wheeler suspension spring is studied. Most of time springs were failed due to raw material defects, surface imperfection, improper heat treatment, corrosion and decarburization and high weight of suspension. These problems can be solved by applied thick layer of paint as adhesive, proper heat treatment, change in shape and material of helical compression spring. In this work, the spring rate can be increased by change in structure i.e. change in number of active coils of spring. The static stress analysis using finite element method is done.*

**Keywords***: helical compression spring, two wheeler, raw material, paint, spring rate.*

## 1. Introduction

### A. Suspension system

Suspension system consists of a spring and a damper. The energy of road shock cause the spring to oscillate. These oscillations are restricted to a reasonable level by the damper which is more commonly called a shock absorber. The vehicle suspension system is responsible for the vehicle control, Driving comfort and safety as the suspension carries the vehicle body and transmit all the forces between the rod and the body.

### B. Spring

A spring is defined as an elastic machine element that deflects under the action of the load and returns to its original shape when the load is removed. It can take any shape and form depending upon the application.

### C. Helical spring

The helical springs are made up of a wire coiled in the form of helix and are primarily intended for compressive or tensile loads. The cross-section of wire from which the spring is made may be circular, square or rectangular. The two forms of helical springs are compression helical spring and tension helical spring. The most popular type of spring is helical compression spring. There are two basic types of helical compression spring Compression spring and Extension spring. In helical compression spring, the external force tends to shorten the spring. The external force acts along the axis of the spring and induces torsion shear stress in the spring wire. It should be noted that although the spring is under compression, the wire of helical compression spring is not subjected to compression stress. Also the wire is not subjected to tensile stress although the spring is under tension. In both cases, torsion shear stresses are induced in the spring wire. The helical spring sometimes classified as closely coiled helical spring and open coiled helical spring

## 2. Static Analysis

For the above specification of the helical compression spring, the static analysis is performed using ANSYS 16.2 to find out the maximum deflection for the corresponding theoretical load. The analysis results are as follows

### 2.1 Existing Spring

Theoretical loads are applied on the spring as follows

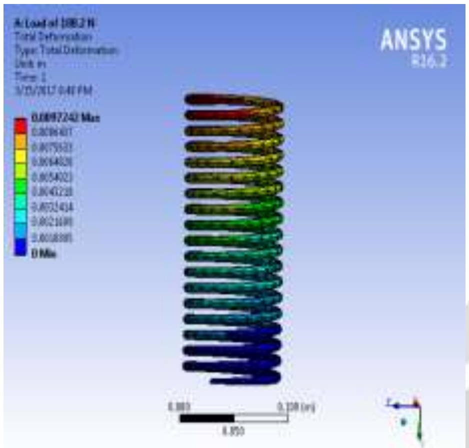


**Fig.1** Maximum deflection at load 188.2 N

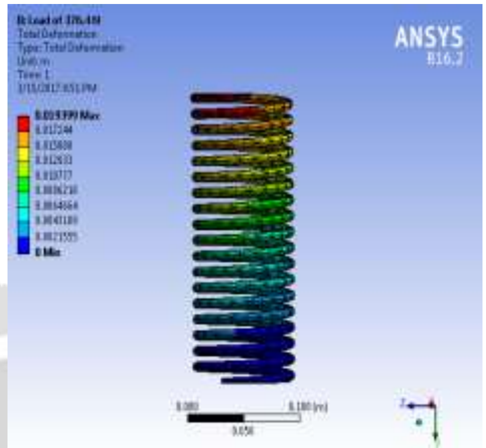


**Fig.2** Maximum deflection at load 376.4 N

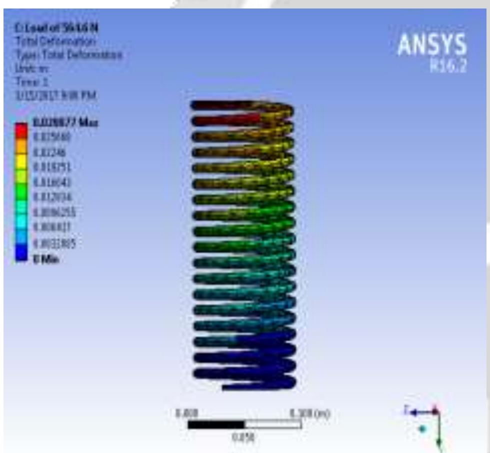


**Fig.3** Maximum deflection at load 576.2 N

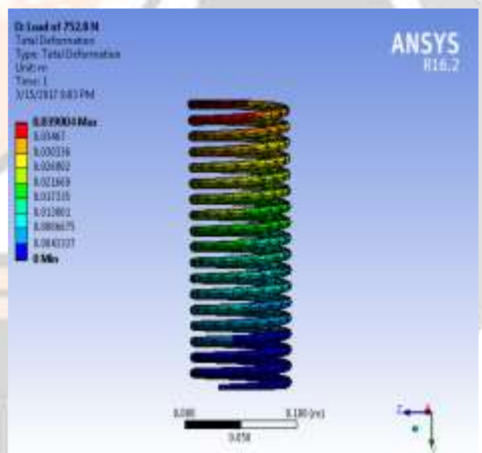


**Fig.4** Maximum deflection at load 752.8 N

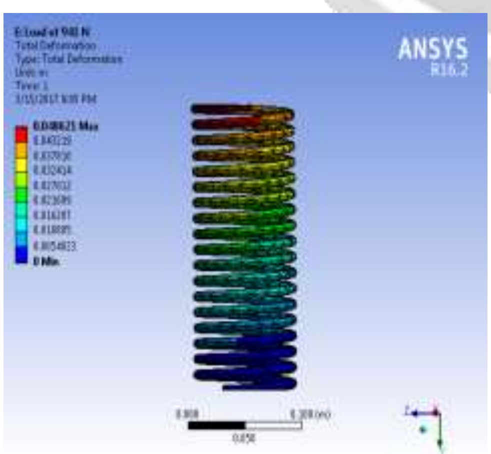


**Fig.5** Maximum deflection at load 941 N

### 4.2 New spring I

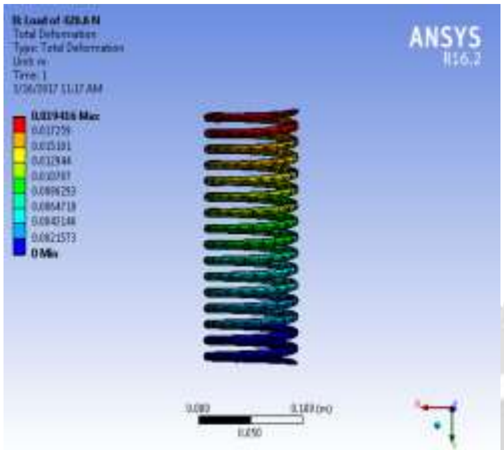


**Fig.6** Maximum deflection at load 426.6 N

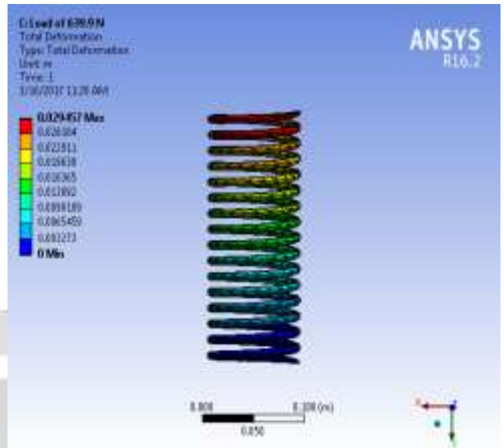


**Fig.7** Maximum deflection at load 639.9 N

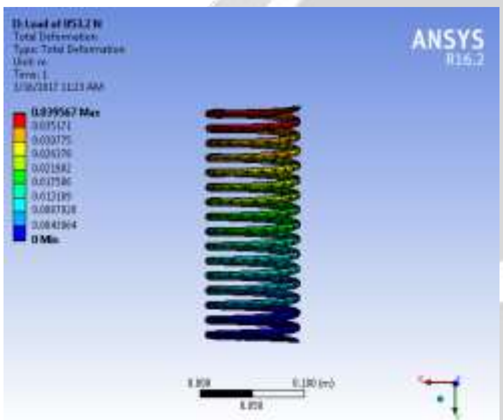


**Fig.8** Maximum deflection at load 853.2 N

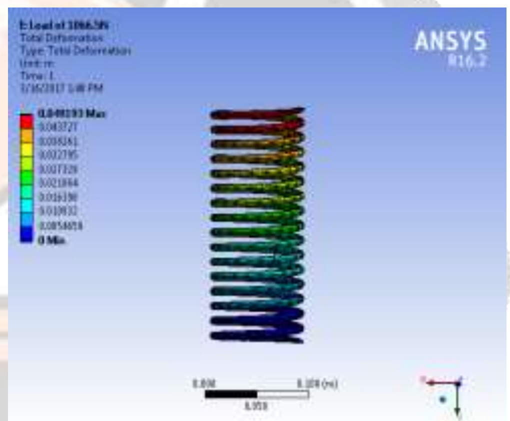


**Fig.9** Maximum deflection at load 1066.5 N

### 4.3 New Spring II

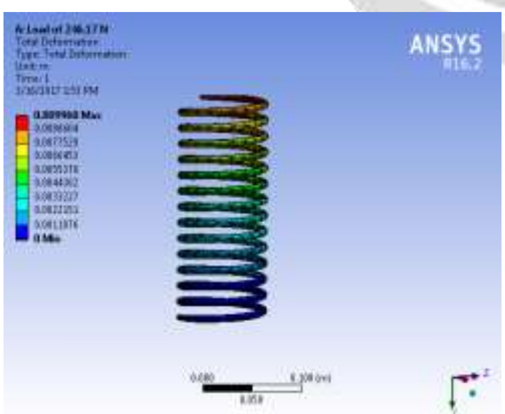


**Fig.10** Maximum deflection at load 246.17 N

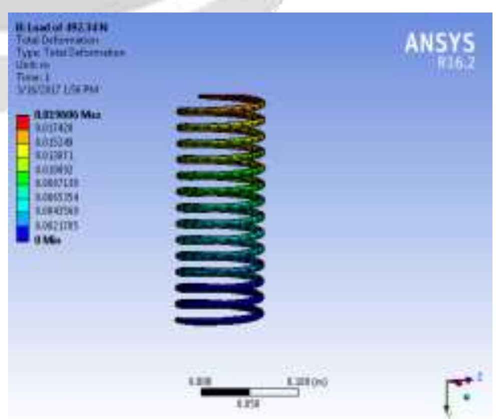


**Fig.11** Maximum deflection at load 492.3 N

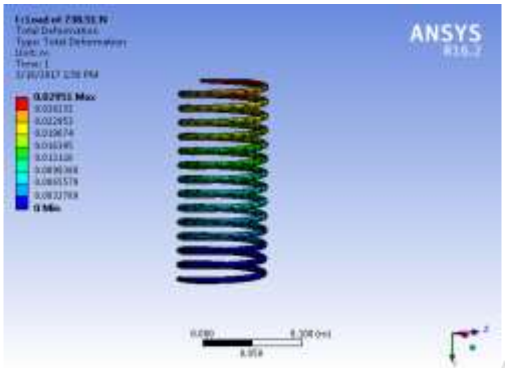


**Fig.12** Maximum deflection at load 738.51 N

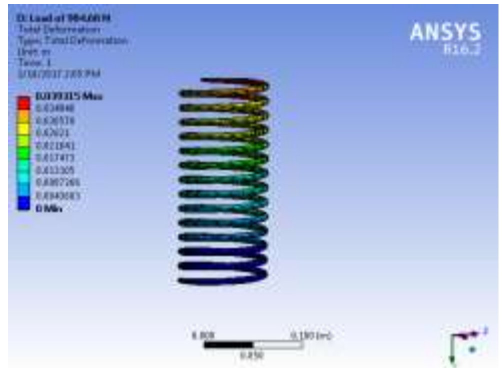


**Fig.13** Maximum deflection at load 984.6 N

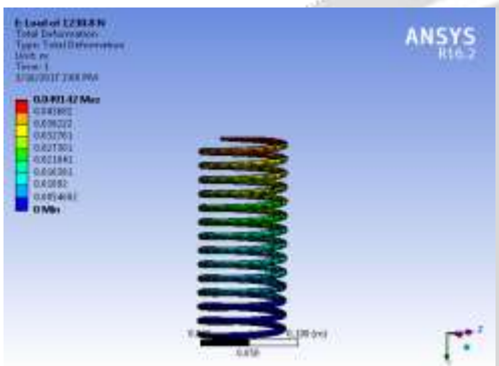


**Fig. 14** Maximum deflection at load 1230.8 N

## 5. Results

**Table No. 1** Deflection at various loads

| Sample | | Deflection at various load in mm | | | | |
|---|---|---|---|---|---|---|
| Existing Spring | Load (N) | 188.2 | 376.4 | 564.6 | 752.8 | 941 |
| | Deflection (mm) | 9.724 | 19.4 | 28.8 | 39 | 48.62 |
| | | | | | | |
| New Spring I | Load (N) | 213.34 | 426.6 | 639.9 | 853.2 | 1066.5 |
| | Deflection mm) | 9.87 | 19.42 | 29.45 | 39.56 | 49.19 |
| | | | | | | |
| New Spring II | Load (N) | 246.17 | 492.34 | 738.51 | 984.6 | 1230.8 |
| | Deflection (mm) | 9.97 | 19.6 | 29.51 | 39.31 | 49.14 |

## 6. Conclusion

Analysis of helical compression spring used in two wheeler suspension system is done with the help of finite element analysis. For this purpose three springs are used namely existing spring, new spring I and new spring II. Theoretical loads are used for analysis. For that loads, deflections are find out. It is concluded that load carrying capacity of new spring II is increased than existing & new spring I.

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