ANALYSIS HONING MACHINE PARAMETERS OF SCREW BARREL FOR INJECTION MOLDING MACHINE

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ABSTRACT

Honing is a machining process that can economically produce very exact bores regarding form, geometry and surface quality. It is mainly used as the final finishing operation for ready made parts and typically conducted on the inner surface of a cylinder and it can useful for the longer bores up to 1m to 5m. Due to their specific surface structure which has a good ability to keep lubricants and a high wear resistance, honed parts usually serve as functional surfaces to guide moved parts. Honing is an abrasive machining process using abrasive grains usually made of diamond or Cubic Boron Nitride (CBN) in metallic bonding.

Keyword: - *Honing Machine, Analysis, Fine finishing, Honing Parameter*.

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1. INTRODUCTION

Honing is an abrasive manufacturing process that can produce economical part removal together with very exact work piece results regarding geometric and form accuracy as well as surface quality. Honing is often used as the final finishing operation for ready-made parts, especially where parts are moved against each other, e.g. in piston raceways in engine blocks or – on a smaller scale – in fuel injection pumps. - Through honing a wide range of parts, regarding their size and material, can be manufactured. This paper deals with the internal long stroke honing of long bores.

In this project the height of honing machine is long up to 3m to 5m. Honing tool is connected to honing Profile. Honing profile moves upwards and downwards directions with the support of four guide rod and Hydraulic Actuator, by the help of this process honing tool making better internal diameter finishing of screw barrel.
If actuator lost his control then accident may be created, to stop the accidental problem, so we can construct Helical Compression Spring, this spring are mounting on the honing base profile between each guide rod.

The traditional form of honing is an open loop control called feed-controlled honing. A newer approach, that so called force-controlled honing, uses a closed loop control. In the case of force-controlled honing the forces occurring during the process are measured and kept constant through a regulation of the feeding movement.

This constant process force helps to reach a more stable. honing process regarding the quality parameters, the material removal and the wear of the honing stone. A force-controlled approach can help to increase the process stability, the quality of the honed work pieces and the tool life. It also helps to reduce the running-in period of the process and makes it possible to hone in small lot sizes. The presented study explains the differences between the two control types and shows the advantages of the force controlled approach.

1.1 Honing Stone

The honing stone contains three material components, abrasives, bonding material and additives. The abrasives can be divided into two groups, conventional and super-abrasives. Conventional abrasives are ceramics such as aluminum oxide and silicon carbide, while super-abrasives are made out of diamond or cubic boron nitride. Diamond grains have been proven to better resist wear and create a better surface than other abrasives. The size of the abrasive grain varies depending on the required surface texture and metal removal rate. Larger grain sizes will increase the material removal rate but lead to a poor surface quality.

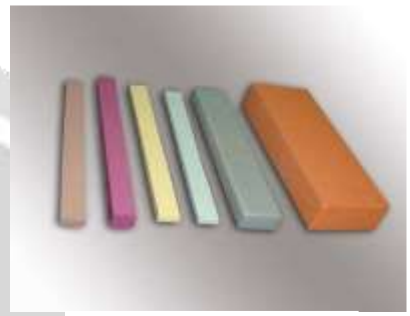


Fig -1: Honing Stone

1.2 Honing Oil

A critical part of the honing operation is the honing oil. Additional to the lubrication, the honing oil contributes by cooling the work piece and honing tool as well as by flushing the swarfs away from the cutting process. By keeping the process at the right temperature, both cylinder liner and stone can be preserved to ensure quality and lower production cost. The most common fluid used is mineral oil. This is due to its high viscosity and high flash point. Another benefit of the oil is that it does not irritate the skin of the machine operators.

Fig -2: Honing Oil

2. EXPERIMENTAL SETUP

Honing is an abrasive machining process with geometrically undefined cutting edges. The process is mainly characterized by three overlaying movement components: a rotational movement along the tool axis, an axial stroke movement and the feeding movement of the honing stone. In our honing machine there are four guide rod mounted on the honing base profile. Honing base are totally 4m to 6m construed below the land level, because the total height of the honing machine 10m to 12m, there it was been constructed below the earth level. Some of the useful parts are constructed on the upper side. The motor and gear box are mounted on the Honing profile. Honing tool are connected with connecting rod and also connecting rod connected to gear box and gear box ratio is 1:15. Honing profile are moving upwards and downwards direction with the help of four guide rod. Bushes are also connected between guide rod because it reduces lot's of friction. Honing machine moving with the help of hydraulic actuator.

In a hydraulic actuator oil pressure is 480 psi when piston goes upwards, and second time when piston goes downwards side the pressure is 510 psi.

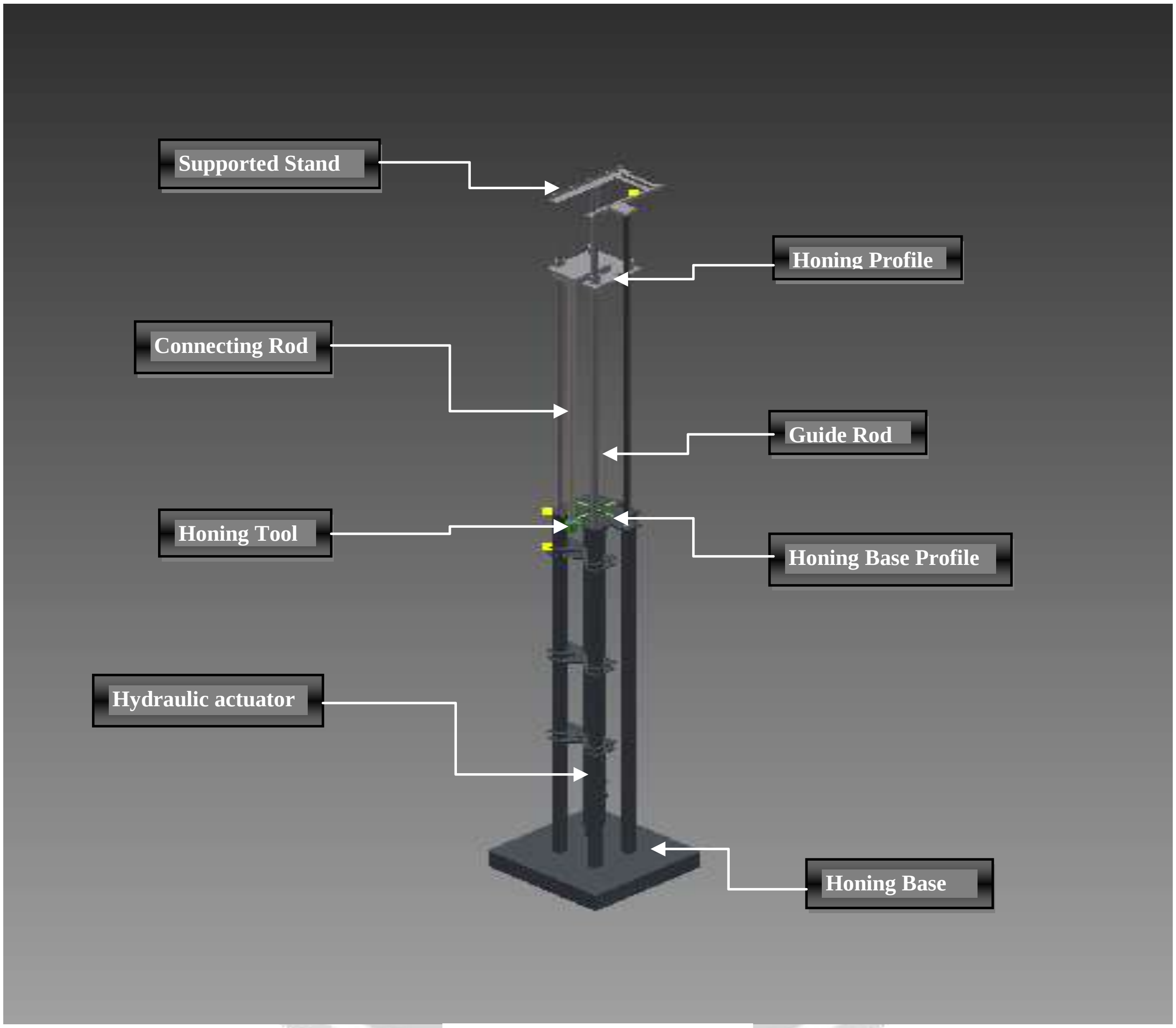


Fig -3: Honing Machine

2.1 Problem Definition

Following are the problems identified while studying about the Honing machine:-

- This Honing machine is very large and it works vertically, so it requires a less flow area.
- This honing machine is a machine which works in vertical axis, due to deteriorate of the hydraulic actuator the honing profile comes upwards side to downwards side.
- And other problem is noise is produced when machine is working process.

3. DESIGN AND CALCULATION

3.1 DESIGN:

We can think about Honing Machine Design with different parameter. In that machine we can constructed a Spring in between Guide rod and Profile. It can absorb up to 4000 N Load To 5000N Load. We can constructed a spring because stop the accidental problem. This Spring is Helical Compressive Spring so it is absorb the compressive load.

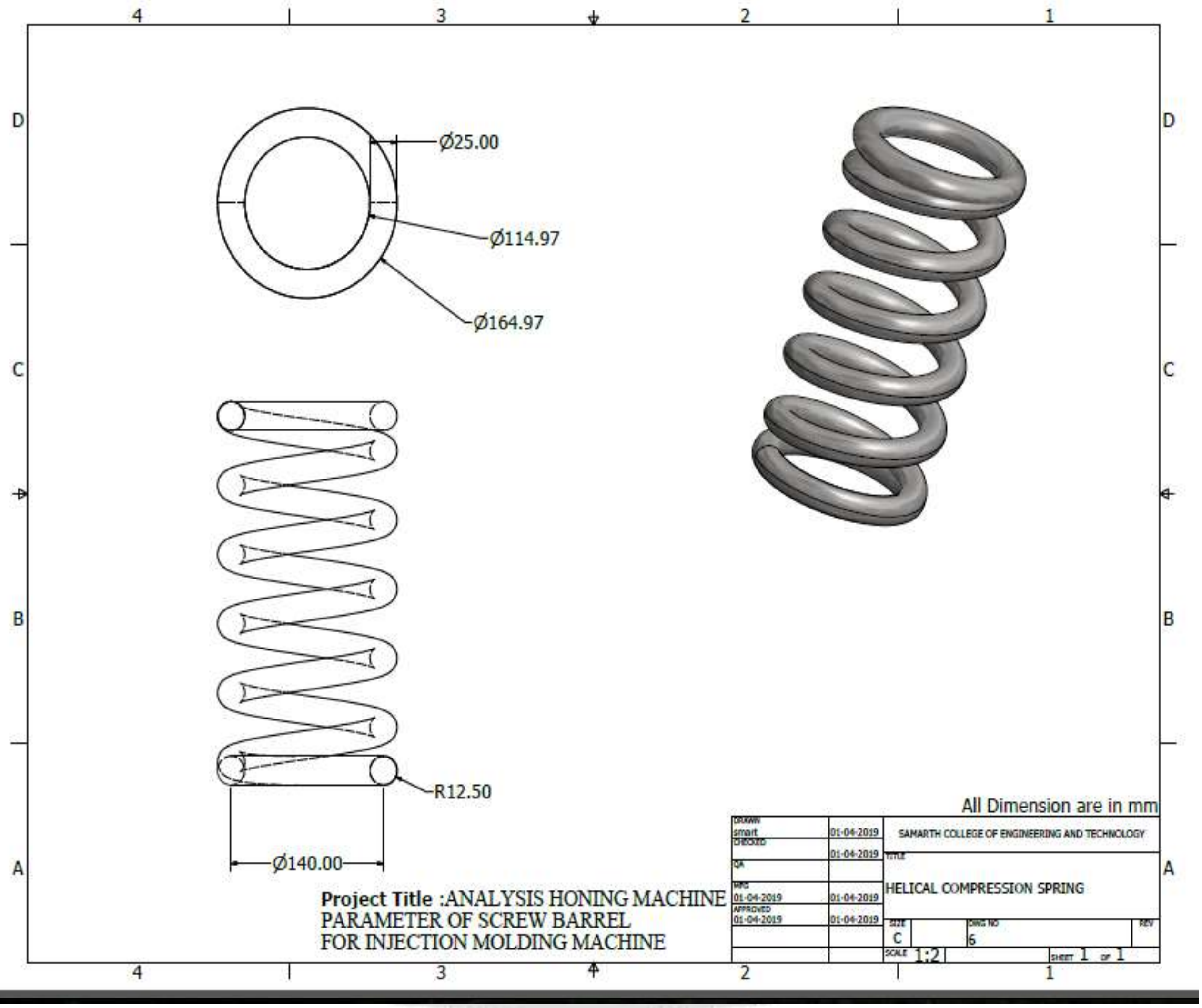


Fig -4: Drawing Sheet of Spring Design

3.2 CALCULATION:

- The Equation of Helical Compressive Spring shown in below :
- Some kind of assumption for Helical Compressive Spring as shown in below :

  -Mean Coil Diameter (D) = 140mm,
  -Wire Diameter (d) = 25mm,

-Height of spring (H) = 300mm,
-Pitch of spring (P) = 60mm,
-Number of active coils (n) =5.
-Axial Load (W) = 1000 N

(1) Spring Index (Ks) :

$$c = \frac{D}{d}$$

(2) Shear Stress Factor (Ks) :

$$k_s = 1 + \frac{1}{2c}$$

(3) Maximum Shear Stress (τ) :

$$\tau = k_s \times \frac{8WD}{\pi d^3}$$

(4) Wahl's Stress Factor (K) :

$$K = \frac{4C-1}{4C-4} + \frac{0.615}{C}$$

(5) Deflection per Active turn ($\frac{\delta}{n}$) :

$$\frac{\delta}{n} = \frac{8WD^3}{Gd^4}$$

3.3 ANALYSIS AND SIMULATION

- **Simulation of Helical Compressive Spring:**

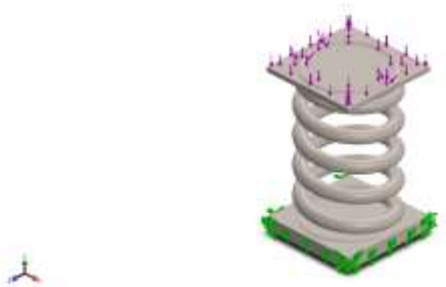


Fig-5: Analysis of helical compressive spring

Volumetric Properties :
Mass : 16.714 Kg,
Volume : 0.0021709m^3

Material Properties :
Name : Alloy Steel,
Yield Strength :6.20422*10^8N/m^2

Density: 7699.11Kg/m^3
Weight : 163.797N

Tensile Strength :7.23*10^8N/m^2
Mass Density :7700kg/m^3

- **Load and Fixture :**

Fixture-1

Fig-6: Spring Base

Fixture Details :
Entities : 4 Edge and 1 face.
Type : Fixture Geometry

Force-1

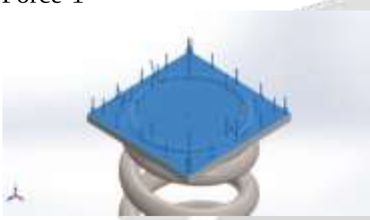


Fig-7: Top of Spring

Load Details :
Entities :3 faces
Type :Apply Normal Force
Value :1000N

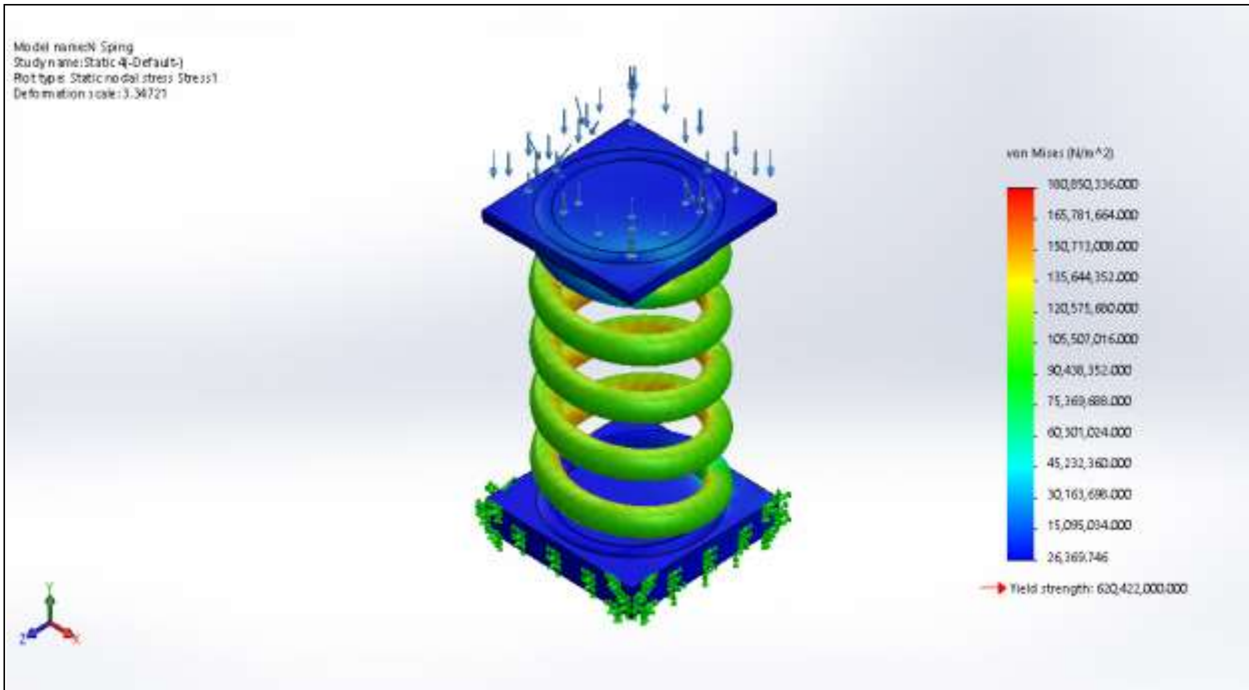
3.4 Study Results

(1) Stress Analysis :

In this spring we can given load 1000N on the top of the spring. Maximum stress is 180,850,336.000N/m^2.

And Minimum Stress is 26,369.746 N/m^2.

Name		Min	Max
Stress1		26,369.746 N/m^2 Node: 1877	180,850,336.000N/m^2 Node: 14471



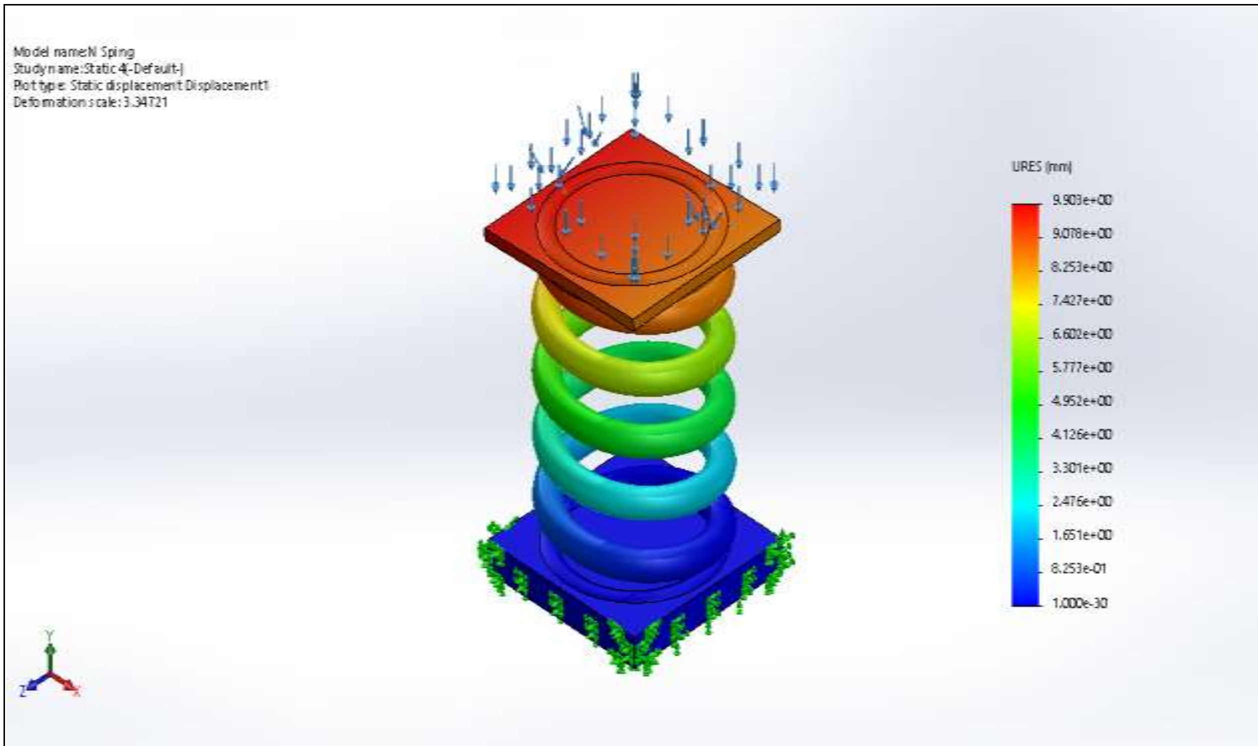
Sping-Static Stress-Stress1

Fig-8: Stress Analysis of spring

(2) Displacement Analysis:

In this spring we can given load 1000N on the top of the spring. So maximum displacement per active ton is 9.903mm. Then maximum displacement is 45 to 50mm.

Name	Type	Min	Max
Displacement	URES: Resultant Displacement	0.000e+00 mm Node: 1652	9.903e+00 mm Node: 1481



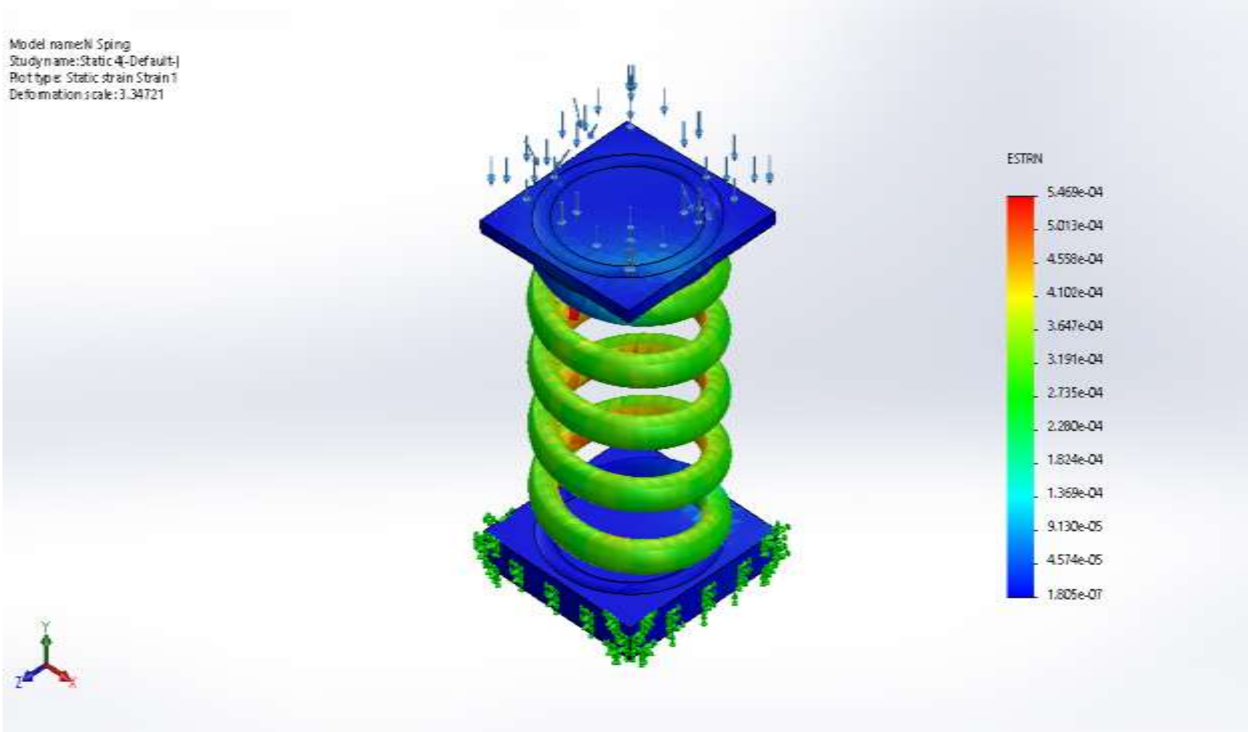
N Sping-Static 4-Displacement-Displacement1

Fig-9: Displacement Analysis of spring

(3) Strain Analysis:

In this spring we can given load 1000N on the top of the spring.

Name	Type	Min	Max
Strain1	ESTRN: Equivalent Strain	1.805e-07 Element: 4699	5.469e-04 Element: 4829



N Sping-Static 4-Strain-Strain1

Fig-10: Strain Analysis of spring

4. CONCLUSIONS

- We can use of helical compressive spring so safety will be maintain.
- When profile is goes to 5m upwards side unfortunately in hydraulic actuator oil pressure will be increased therefore it is possible to break down the actuator so honing profile fully loaded falling downwards side created an accidental problem.
- But we can use compressive helical spring for absorbing heavy load and free from accidentental problems.

5. REFERENCES

[1] Schmitt C, Bähre D, Forsch K, Klein H. Feinstbearbeiten hochgenauer Bohrungen durch Honen. Jahrbuch Schleifen, Honen, Läppen und Polieren, 65. Ausgabe; 2011. (only available in German, translated title: "Fine machining of precise bores through honing")

[2] Todd R, Allen D, Alting L. Honing. In: Manufacturing Processes Reference Guide: Industrial Press Inc; 1994. p. 65-70.

[3] Tolinski M. High-Performance Honing. Manufacturing Engineering, June 2008. Vol. 140, No.6.

[4] Bähre D, Schmitt C, Moos U. Comparison of Different Approaches to Force controlled Precision Honing of Bores. Proceedings of NAMRI/SME, Vol. 40; 2012.

[5] ElMaraghy H, Schuh G, ElMaraghy W, Piller F, Schönsleben P, Tseng M, Bernard A. Product variety management. CIRP Annals – Manufacturing Technology 62; 2013. p.629-652.