A SCHEMATIC STUDY AND ANALYSIS OF WAVE SPRING FOR MOTOR CYCLE SHOCK ABSORBER

CHUNDURU PAVAN KUMAR
Machine Design
Velaga Nageswara Rao College of Engineering and Technology
pavanME304@gmail.com

KARRA NAMCHARAIAH
Assistant professor
Velaga Nageswara Rao College of Engineering and Technology
karrachary40@gmail.com

ABSTRACT:

Suspension is the term given to the machine of springs, surprise absorbers and linkages that connects a car to its wheels and permits relative motion between the two. In this task we are able to increase a wave spring which can be replace The coil spring in present motors and check it the usage of Ansys workbench, dimensions and special variables are taken from previous papers and works, for layout purpose we are capable of use Catia v5r20. Springs are made from a spread of elastic substances, the most commonplace being spring steel. Small springs may be wound from pre-hardened stock, at the same time as large ones are made from annealed metal and hardened after fabrication. Some non-ferrous metals also are used along with phosphor bronze and titanium for parts requiring corrosion resistance and beryllium copper for springs wearing electrical cutting-edge. Materials for analysis taken as spring steel grade 38Si6 (EN- series4), ASTM 301 and A1095 as preferred by taking these alloy properties in to account.

Key words: *wave spring, shock absorber, materials.*

1.0 INTRODUCTION

WAVE SPRING:

Wave spring peak to top wave springs paintings as a heap bearing machine, the use of a bowing minute in preference to relying on torsion. Giving an indistinct power and redirection from ordinary springs, wave spring improvement dispenses with material utilization thru as a lot as half of, leaving a light-weight, bendy object that may address troubles and enhance new trouble format

DIFFERENT TYPES OF WAVE SPRINGS:

Crest-to-Crest Wave Springs – diminish spring tallness by up to half.

Crest-to-Crest Wave Springs + Shim Ends – diminish tallness and give 360° surface contact.

Single Turn Wave Springs – hole and cover styles to supplant stamp wave washers.

Wave Springs – round wire rather than level, gives higher powers than single turn wave springs.

Linear Springs – straight lengths to get hub weight.

Nested Wave Springs – Pre-stacked springs from a solitary constant fiber**.**

Edge twisting spring-tempered level wire to outline our Single Turn Springs is more strong, correct, and repeatable than its stamped accomplices. For a few applications having another option to fit the spring decisively to the right separations crosswise over upgrades execution and can as often as possible help the social gathering procedure.

Springs are produced using just a single wire, and in this way couldn't be more clear in numerous respects, yet they hold the bright structure to be powerfully utilitarian, solid and totally basic to various parts. From helical circles to more abnormal shapes and layouts, the unassuming spring is a significant segment that various endeavors couldn't oversee without.

2.0 LITERATURE REVIEW

P.R. Jadhav1, N.P.Doshi ,U.D. Gulhane [1] the research of elastomeric masking effect on effective thunderous anxieties esteems in spring is added in this paper. The fitting situations figuring out the viability of dynamic stress lessening in thunderous conditions as an element of masking parameters have been determined. It was confirmed that elastic masking may not perform in appealing direction because of its low modulus of pliability in shear. It

become in like way established that about resonation locales of prolonged tensions are greater extensive and greater extensive close by the dynamic resonances and reap basic regards even wherever isolates from the resonation frequencies.

Dr. Dhananjay. R. Dolas , Kuldeep. K. Jagtap [2] Long haul exhaustion checks on shot peened helical strain springs were coordinated through strategies for an unusual spring exhaustion trying out machine at 40 Hz. Test springs were made of three unique spring substances oil cemented and tempered Si Cr-and Si Cr V-alloyed valve spring metal and stainless steel. With an great check approach in a trial, as much as 500 springs with a twine cast off crosswise over of d = 3.Zero mm or 900 springs with d = 1.6 mm had been tried within the interim at unique nervousness tiers. In angle of shortcoming examinations of springs with d = three.Zero mm as much as distinct cycles N = 109 an examination become performed after the take a look at changed into endured to N = 1.5 - 109 and their effects had been taken a gander at. The impact of various shot peening situations have been inquired approximately in springs with d = 1.6 mm. Broken take a look at springs were investigated under optical amplifying focal point, sifting electron amplifying tool (SEM) and by using strategies for metallographic littler scale portions remembering the ultimate objective to examinations the damage lead and the mistake segments. The paper fuses a connection of the consequences of the differing spring sizes, substances, quantity of cycles and shot peening conditions and designs support examinations inside the VHCF-territory.. For examination the effects for the springs with d = 1.6 mm and d = three.Zero mm and Ps = 98% are compressed Except for springs manufactured from the stainless steel cord, the fatigue nature of springs with d = 3.Zero mm is better than for springs with d = 1.6 mm. The size effect might suggest better depletion pleasant for tinier twine gets rid of over

T S Manjunatha and D Abdul Budan [3] Elastomeric segments have wide use in various endeavors. The normal organization stacking for most of these fragments is variable sufficiency and multi hub. In this examination a general approach always estimate of elastomeric parts under these normal stacking conditions was created and spoken to for an explorer vehicle bolster mount. Split begin life desire was performed using various mischief criteria. The methodology was affirmed with part testing under different stacking conditions including consistent and variable adequacy in-dispose of and of-arrange axial– torsion tests. The perfect methodology for split begin life estimate for complex multi urgent variable adequacy stacking was seen to be an essential plane approach in light of most noteworthy conventional strain plane and damage assessment by breaking imperativeness thickness on that plane. Rain stream cycle checking strategy and Miner's straight mischief run were used for reckoning exhaustion life under factor plenitude loadings. The break mechanics approach was used for indicate weariness life gauge of the fragment in light of illustration split improvement data and FE reenactment comes to fruition. Mean depletion life desire comes to fruition exhibited extraordinary simultaneousness with tests for most of the stacking conditions considered.

Harshal Rajurakar1, M. C. Swami [4] High cycle weakness (VHCF) properties of an as of late developed clean spring steel was probably examined under turning contorting and center stacking. Likewise, this steel addresses the duplex S– N property only for surface-started disillusionment under rotating contorting, while it addresses the single S– N property for surface-incited frustration and inside inhomogeneous littler scale structure actuated dissatisfaction under center point stacking. Surface small crushing flaw instigated disillusionment is the extraordinary dissatisfaction technique for this steel in VHCF organization. The

surface morphology of within inhomogeneous microstructure with unmistakable plastic distortion is extensively rougher than that of the including cross section, which implies the anxiety focus came about because of the strain irregularity between the miniaturized scale basic in homogeneity as delicate stage and the surrounding grid as hard stage assumes a key part in causing inside break start. Considering the impact of surface compressive lingering stress, the edge push force factor for surface little deformity prompted break proliferation of this steel is assessed to be 2.04 MPam1/2, which implies that the short split impact assumes a key part in causing the surface little imperfection actuated disappointment of this steel in the VHCF administration. From the perspective of deformity appropriation, surface and inside disappointment probabilities are comparable under a settled trademark estimation of imperfection thickness. On the off chance that the inside imperfection estimate is not exactly or even equivalent to the surface deformity

P.R. Jadhav, N.P. Doshi,U.D Gulhane [5] This paper displays a 3D geometric demonstrating of a twin helical spring and its limited component examination to contemplate the spring mechanical conduct under pliable hub stacking. The spiraled shape visual computerization is accomplished using Computer Aided Design (CAD) instruments, of which a limited component demonstrates is created. Therefore, a 3D 18-dof pentaedric components are utilized to discrete the complex "wired-shape" of the spring, permitting the examination of the mechanical reaction of the twin spiraled helical spring under a pivotal load. The examination gives a reasonable match between the advancement of the hypothetical and the numerical elastic and pressure ordinary anxieties, being of sinusoidal conduct. The general identical anxiety iso values increments radially from 0_ to 180_, being maximal on the inside outspread zone at the segment 180_. Then again, the base anxiety level is situated in the focal point of the fiber cross area.

3.0 METHODOLOGY

WAVE SPRING DESIGN GENERAL CONSIDERATIONS

If a spring is intended for static application, ensure that the % worry at working tallness is under 100%. Spring will take a set if subjected to a higher anxiety.

If a spring is intended for dynamic application, ensure that the % worry at working stature is fewer than 80%. Spring will take a set if subjected to a higher stress.

Few things to recollect:

If the work stature per turn is under (2 * Wire Thickness), the spring will work in a 'non-straight' range and real loads might be higher than ascertained

Number of turns must be in the vicinity of 2 and 20

Number of waves per turn (N) must be in ½ increases

Min. Spiral divider = (3 * Wire Thickness)

Max. Spiral Wall = (10 * Wire Thickness)

It is NOT prescribed to pack a wave spring to strong

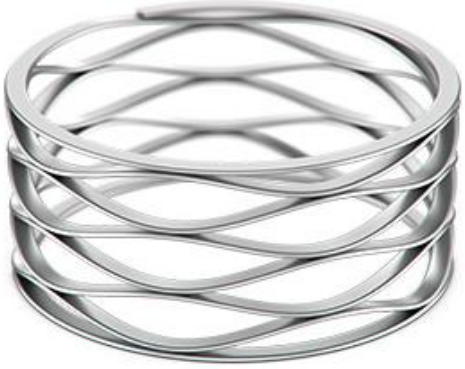
OD extension and OD resistance must be considered while outlining a spring to fit in a drag as well as finished a pole

BASIC PRINCIPLE OF WAVE SPRING:

- Wave springs lessen spring stature by half
- Same power and diversion as common loop/pressure springs
- Wave springs fit tight outspread and hub spaces

Over 4,000 standard springs in carbon and stainless steel (.188" to 16", 5 mm to 400 mm breadths) No Tooling Charges™ on specially crafts (.157" to 120", 4 mm to 3000 mm distances across) Exotic combinations accessible Smalley Wave Springs (Flat Wire Compression Springs) offer the special favorable position of space investment funds when used to supplant curl springs. By lessening spring working stature, wave springs additionally create a diminishing in the spring hole.

With a littler get together size and less material utilized as a part of the assembling procedure, a cost investment funds is figured it out



DESIGN CACULATIONS FOR TWO WHEELAR SUSPENSION SYSTEM

Mean diameter of a coil D=62mm
Diameter of twine d = 8mm
Height h = 228 mm
Outer diameter of spring coil D0 = D +d =70mm
No of energetic turns n= 17
Weight of bike appearing on suspension = 113kgs
Let weight of one character = 75Kgs.
Weight of 2 people = seventy five×2=150Kgs.
Weight of bike + persons = 263Kgs
Rear suspension = sixty five% of 263 = 170Kgs
Considering dynamic masses it is going to be double W =340Kgs = 3335N.
For unmarried surprise absorber weight = w/2= 1667N = W
We Know that,
Compression of spring (δ) = 8FC3nGd4
C = spring index = 7.75 = eight
(δ) = 138.212mm
Solid length,
Ls=n1×d=18×8=one hundred forty four mm
Free period of spring,
Lf = strong length+ most compression + Clearance among adjustable coils X 0.15
= one hundred forty four + 138.212 + 0.15 × 138.212 = 302.943 mm
Pitch of coil, P. = 17 mm

MATERIAL PROPERTIES

Spring steel is a low mix, medium carbon steel with an exceptional yield quality. These licenses objects made of spring steel to return to their novel shape despite gigantic bowing or winding

SPRING STEEL:

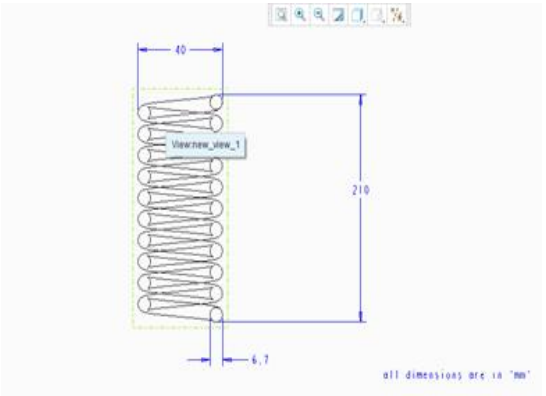
Density	7850kg/m^3
Tensile strength	1700M pa
Young's modulus	210 G pa
Poisons ratio	0.27

Normalized 38Si6 (EN- series4), ASTM 301 and A1095 metallic. It is provided inside the normalized situation. The graph bars at the fabric properties cards below evaluate normalized SAE-AISI 6150 to: wrought alloy steels (pinnacle), all iron alloys (middle), and the whole database (bottom). The duration of each bar shows the given value as % of the most important value in the relevant set

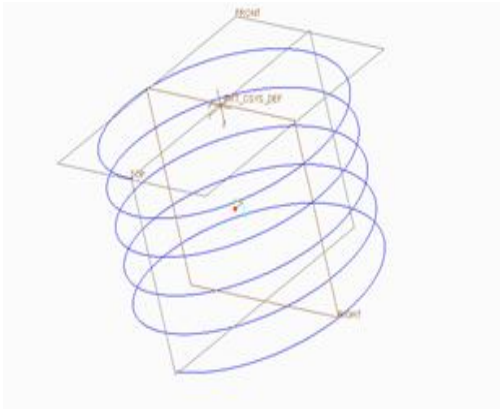
Density	7860kg/m^3
Tensile Strength: Ultimate (UTS)	940M pa
Young's modulus	190 G pa
Fatigue Strength	430 G pa

Materials spring steel:

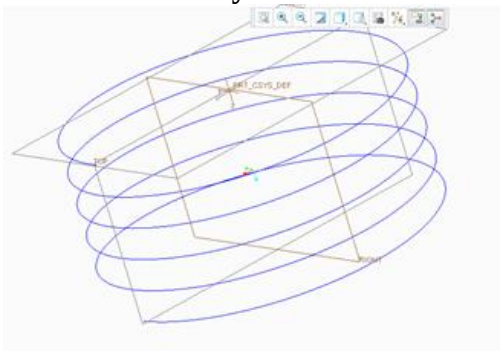
Density = 7860kg/m^3
Young's modulus = 196500n/mm^2
Poisson's ratio = 0.25
Materials chromium vanadium steel
Density = 7800kg/m^3
Young's modulus = 2100n/mm^2
Poisson's ratio = 0.394



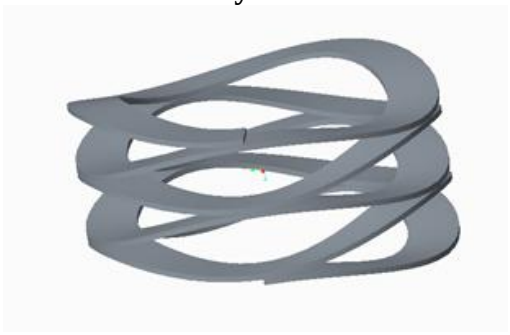
Geometric views



Inner cylindrical coil



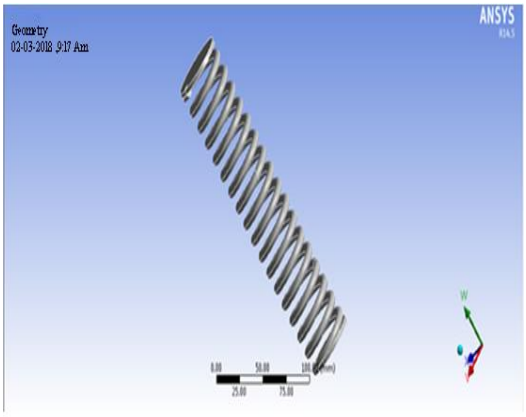
Outer cylindrical coil



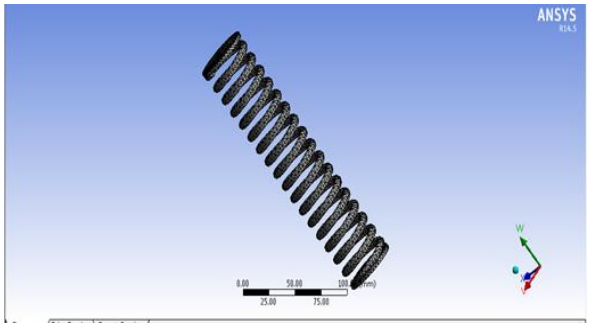
Wave spring

4.0 RESULTS

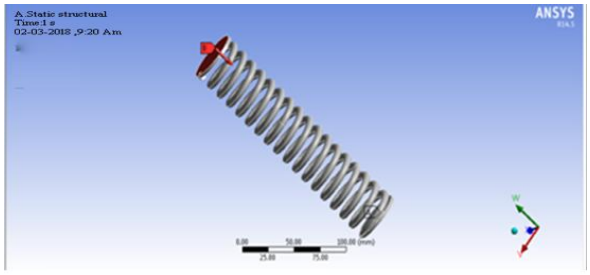
STATIC ANALYSIS OF HELICAL SPRING:



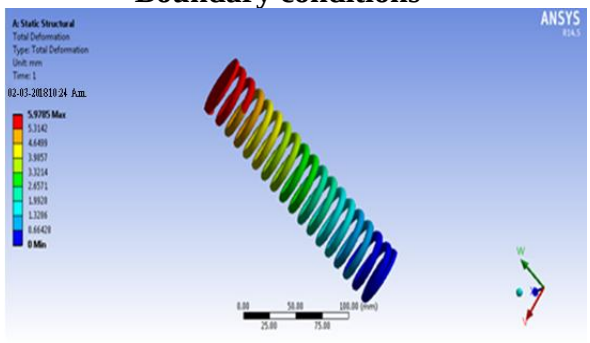
Imported model



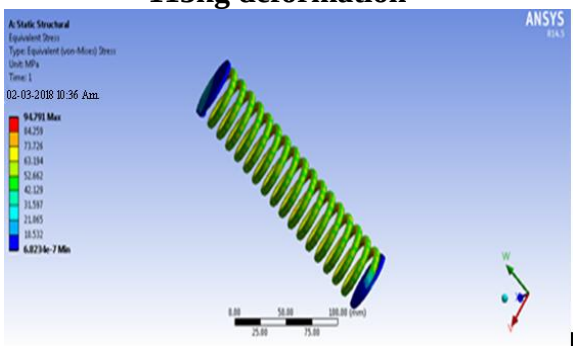
Meshed model



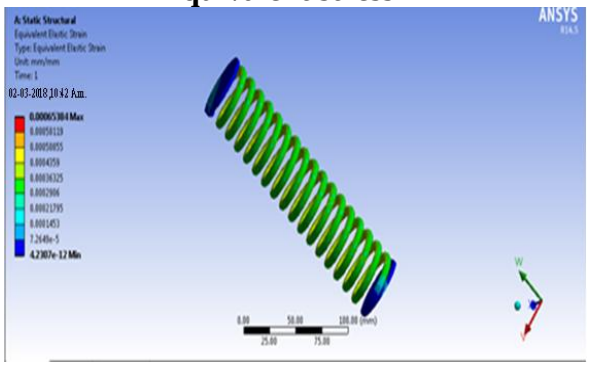
Boundary conditions



Material – spring steel load – bike load 113kg deformation

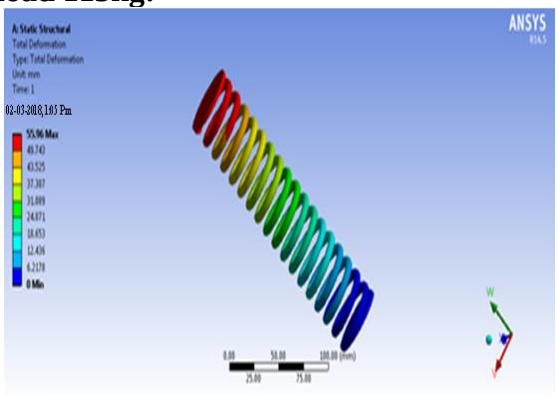


Equivalent stress

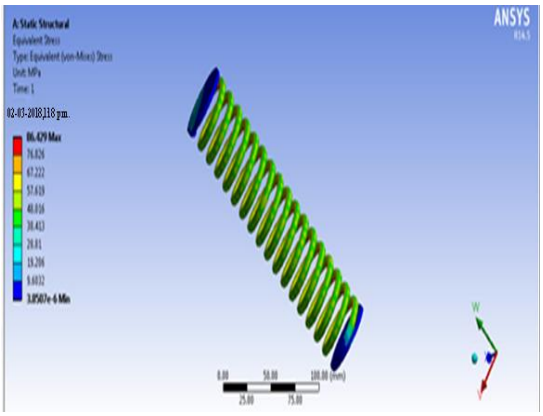


Equivalent elastic strains

Material – astm 301 steel load – bike load 113kg:

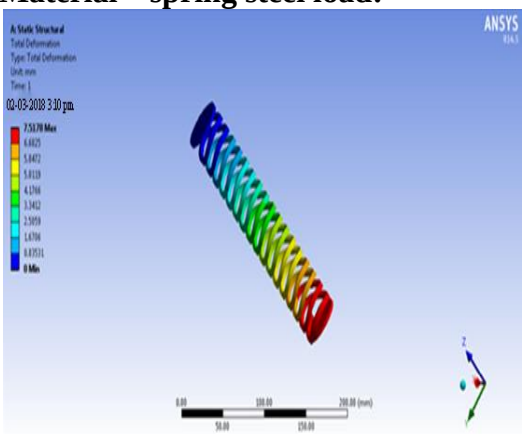


Total deformation

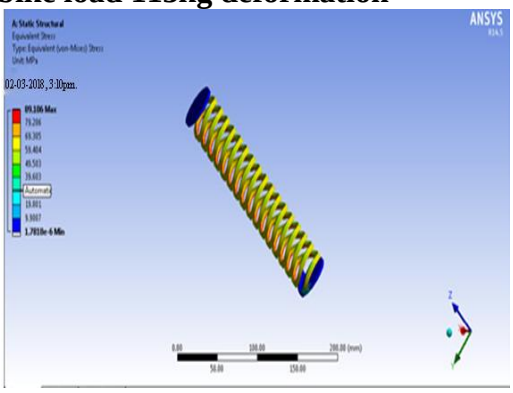


Equivalent stress

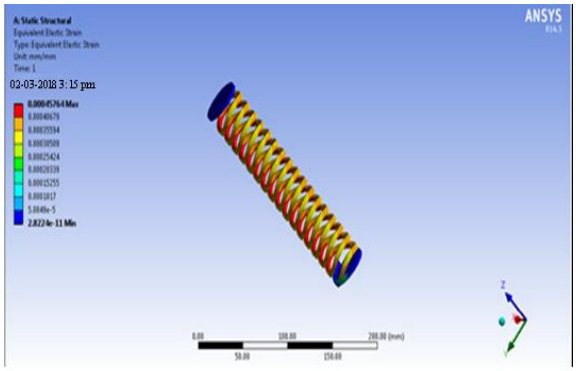
Material – spring steel load:



bike load 113kg deformation

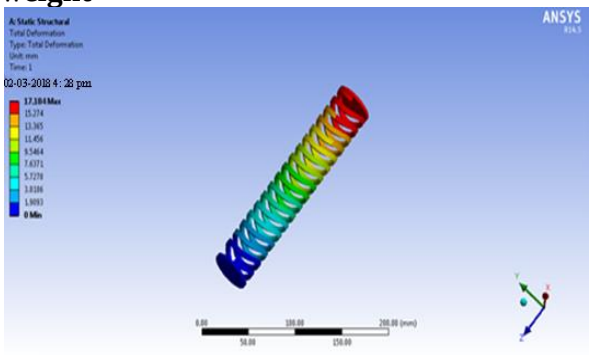


Equivalent stress

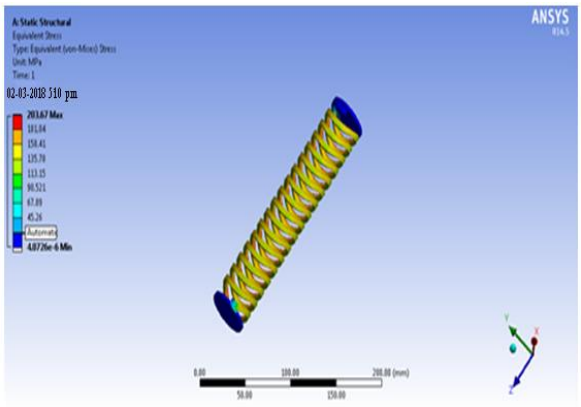


Equivalent elastic strains

Load – bike load 113kg + 2 person weight

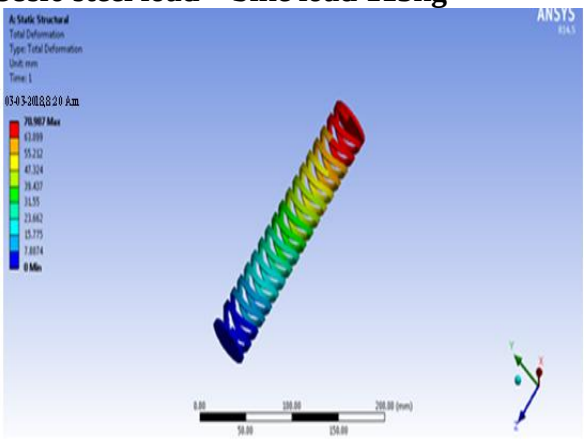


Deformation

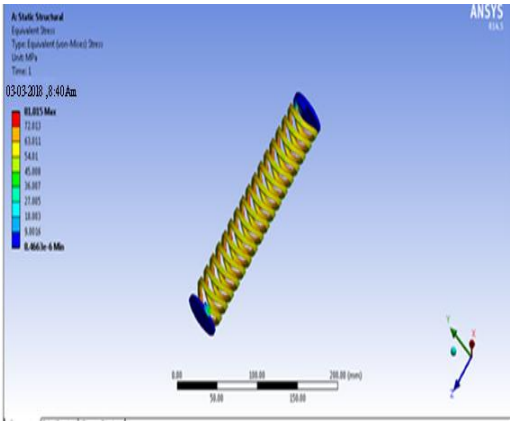


Equivalent von misses stress

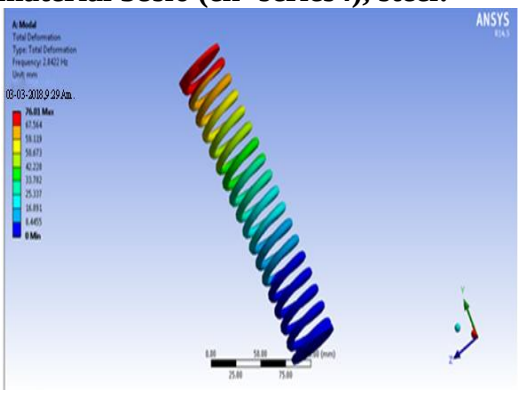
38si6 steel load – bike load 113kg



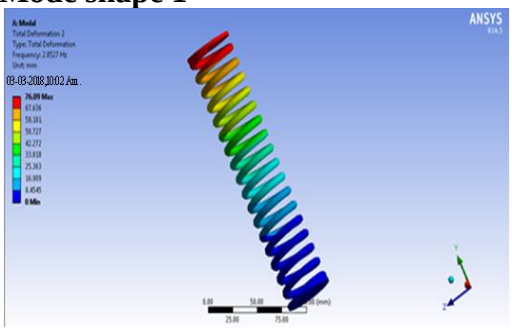
Total deformations



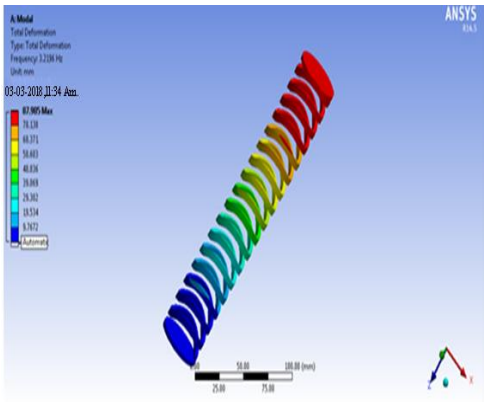
Equivalent von misses stress
material 38si6 (en- series4), steel:



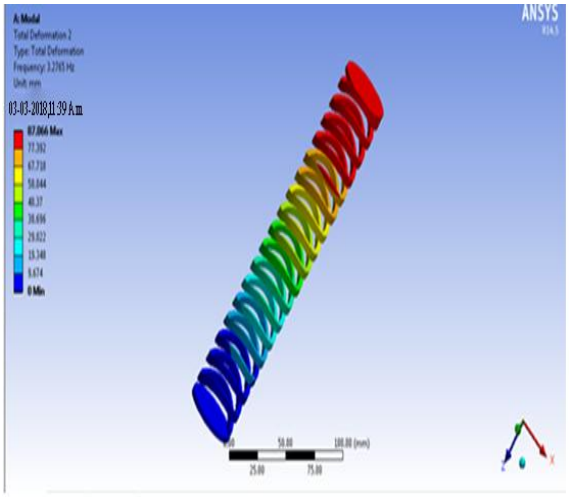
Mode shape 1



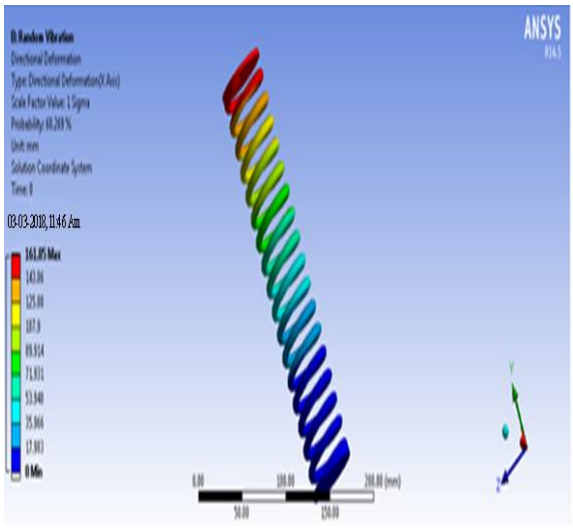
Mode shape 2
Material astm 301 steel:



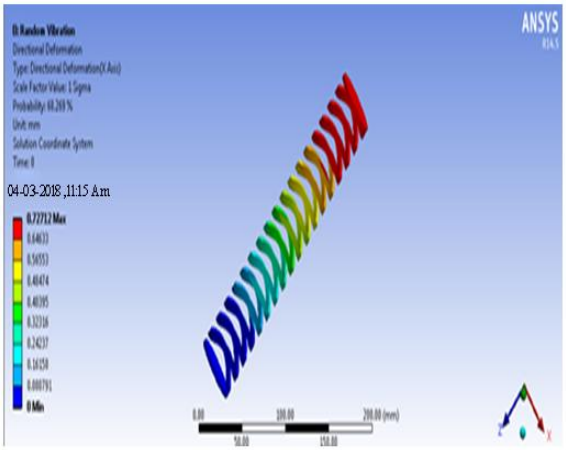
Mode shape 1



Mode shape 2
Random vibration analysis of helical spring
material- a1095:



x- Direction deformations
Random vibration analysis of wave spring
Material-a1095:



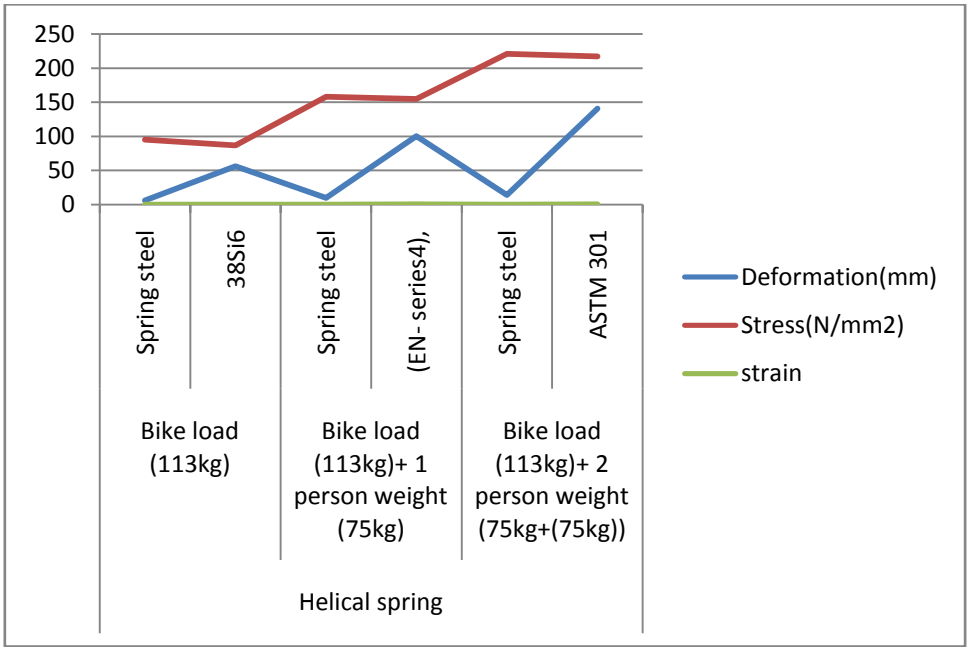
x- Direction deformation

Table static analysis helical spring results

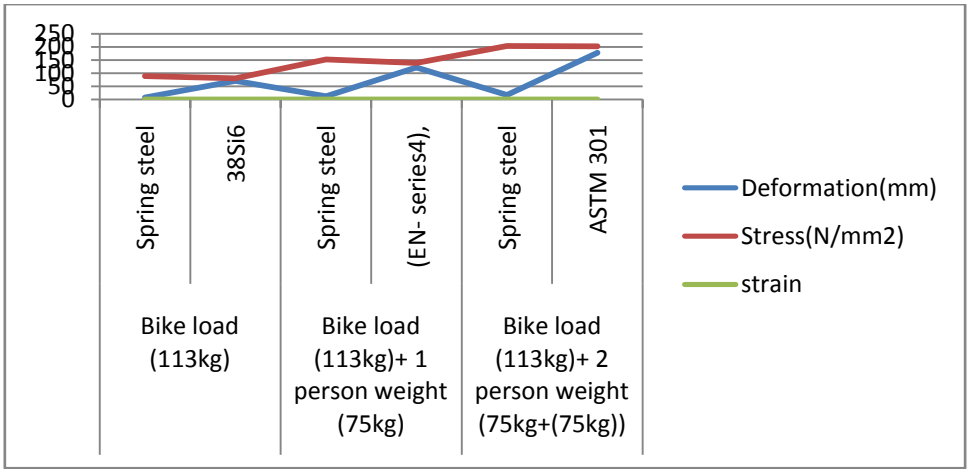
Models	Loads (N)	Materials	Deformation(mm)	Stress(N/mm2)	strain
Helical spring	**Bike load (113kg)**	Spring steel	5.9785	94.791	0.00065384
		38Si6	55.96	86.429	0.0052517
	Bike load (113kg)+ 1 person weight (75kg)	Spring steel	9.9465	157.71	0.0010878
		(EN-series4),	100.06	154.53	0.0093901
	Bike load (113kg)+ 2 person weight (75kg+(75kg))	Spring steel	13.915	220.62	0.0015218
		ASTM 301	140.35	216.76	0.013171

Table static analysis wave spring result

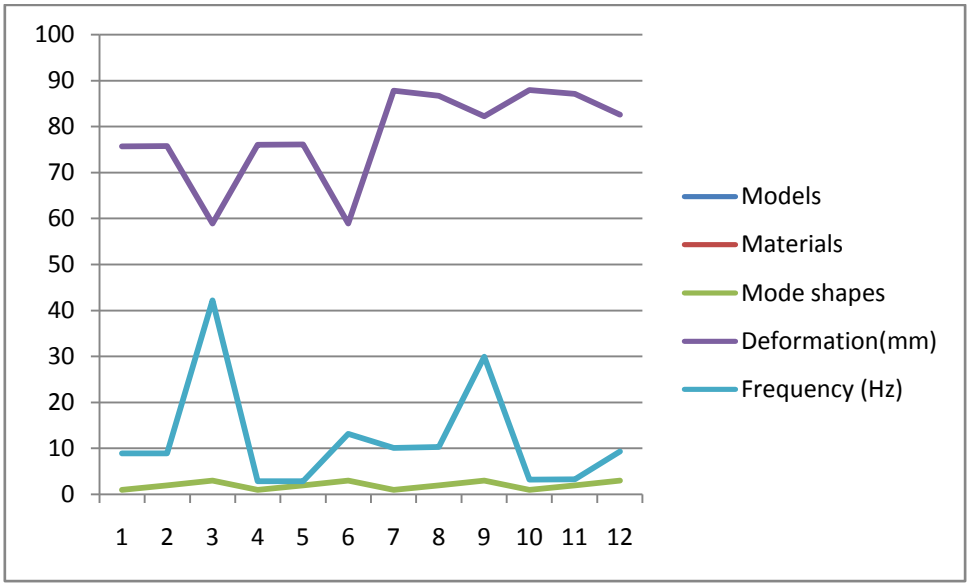
Models	Loads (N)	Materials	Deformation(mm)	Stress(N/mm2)	strain
Wave spring	**Bike load (113kg)**	Spring steel	7.5178	89.106	0.0004576
		38Si6	70.987	81.015	0.0038747
	Bike load (113kg)+ 1 person weight (75kg)	Spring steel	12.888	152.75	0.00078452
		(EN-series4),	122.01	139.24	0.0066597
	Bike load (113kg)+ 2 person weight (75kg+(75kg))	Spring steel	17.184	203.67	0.001046
		ASTM 301	177.47	202.54	0.0096869



Graphs for helical spring deformation plot



Graphs for helical spring stress plot



Graph for helical spring strain plot

CONCLUSION

The design of spring in suspension system is very important. In this project a surprise absorber is designed (helical type spring and wave spring) and a 3-D version is created using CATIA. Structural evaluation and modal evaluation are finished on the suspension machine by way of varying fabric for spring, 38Si6 (EN- series4), ASTM 301 The evaluation is finished by means of considering masses, motorbike weight, single character and 2 people. Structural evaluation is executed to validate the electricity and modal evaluation is achieved to determine the displacements for extraordinary frequencies for range of modes. Comparison is carried out for two substances to verify nice fabric and high-quality version for spring in suspension gadget. Analysis finished in ANSYS

In this thesis the random vibration analysis is decide the directional deformation, shear strain and shear stain for that's the excellent cloth for spring. By looking at the static analysis the weight will increase with the aid of growing the stress, deformation and pressure values. While we compared helical spring and wave spring the strain values are decreased for wave spring with chromium vanadium steel material By looking at the modal evaluation the deformation increases for wave spring and frequencies decreases for

wave spring By watching the static and modal analysis 38Si6 (EN- series4), ASTM 301 fabric is the first-class material for suspension spring so we have performed the random vibration evaluation for 38Si6 (EN- series4), ASTM 301.

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