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Dynamic Analysis Of A Leaf Spring

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ABSTRACT

A Four leaf spring used in suspension of a light vehicle is analyzed by Ansys 14 software. Design and modeling of leaf spring using CREO software. The Finite Element Results Showing stresses and Deflection Verified the Existing Analytical. Dynamic load Analysis analysis of leaf spring using Ansys 14 software.

Keyword**:**Design,Modeling, Dynamic analysis of leaf spring.

1.INTRODUCTION

Leaf springs absorb the vehicle vibrations and bump loads by means of spring deflections, so that the potential energy is stored in the leaf spring and then relieved slowly. Ability to store and absorb more amount of strain energy ensures the comfortable suspension system.

The spring is mounted on the axle of the vehicle. The entire vehicle load rests on the leaf spring. The front end of the spring is connected to the frame with a simple pin joint, while the rear end of the spring is connected with a shackle. Shackle is the flexible link which connects between leaf spring rear eye and frame. When the vehicle comes across a projection on the road surface, the wheel moves up, leading to deflection of the spring. This changes the length between the spring eyes. If both the ends are fixed, the spring will not be able to accommodate this change of length. So, to accommodate this change in length shackle is provided at one end, which gives a flexible connection. During loading the spring deflects and moves in the direction perpendicular to the load applied.

2.SPECIFICATION OF MAHINDRA COMMANDER 650 DI LEAF SPRING OF JEEP[2]

1.Model :Mahindra commander 650 di Jeep
2.Material :Steel EN45A(0.65%C,1.8%Si,0.79%Mn, 0.02%S,0.024P)
3.No of Full Length leaves :02
4.No of graduates leaves :08
5.No of Leaves :10
6.Width :50mm
7.Thickness :6mm
8.Young modulus of leaf spring :210Mpa
9.Ineffective length :100mm

2.1 Material Properties Of Leaf Spring [3]

1. Steel : EN45 A
2. Young Modulus (E) : 2.1×10^5 N/mm^2
3. Poisson Ratio : 0.266
4. Ultimate Tensile strength : 1272Mpa
5. Yield Tensile Strength : 1158 MPa
6.Density : 0.00000785

3.DESIGN PARAMETER OF A LEAF SPRING

Table 1 Design parameter

SRNo	Parameter	Value
1	Design load	6685N
2	Effective length of leaves	526mm
3	Max stress	586mm

4	Deflection of leaf spring	117mm
5	Camber length	58.5
6	Eye diameter	9mm
7	Diameter of center bolt	10mm
8	Length of First Leaves	217mm
	Length of 2nd Leaves	326mm
	Length of 3rd Leaves	440 mm
	Length of 4th Leaves	553 mm
	Length of 5th Leaves	666 mm
	Length of 6th Leaves	780 mm
	Length of 7th Leaves	893 mm
	Length of 8th Leaves	986 mm
	Length of 9th Leaves	1100mm
	Length of 10th Leaves	1151mm
9	Radius of 1st leaves	1452 mm
	Radius of 2nd leaves	1446 mm
	Radius of 3rd leaves	1440 mm
	Radius of 4th leaves	1434 mm
	Radius of 5th leaves	1428 mm
	Radius of 6th leaves	1422 mm
	Radius of 7th n leaves	1416 mm
	Radius of 8th leaves	1410 mm
	Radius of 9th leaves	1404 mm
	Radius of 10th leaves	1398mm
10	Width	50mm
11	Thickness	60mm
12	Diameter of center Bolt	10mm

3.SOLID MODEL OF A LEAF SPRING

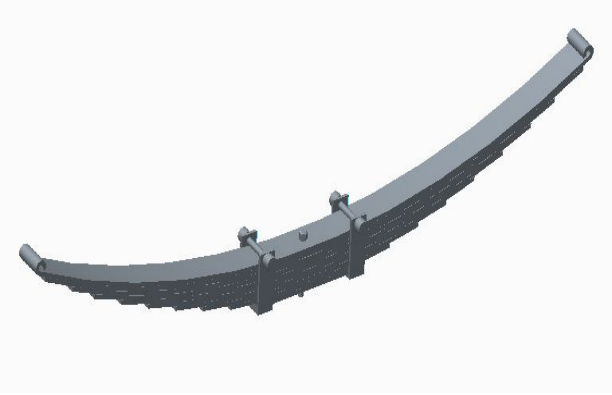


Fig No1.Solid model of a leaf spring created in Creo software.

4.DYNAMIC ANALYSIS OF A LEAF SPRING.

4.1 Dynamic Specification of Mahindra commander 650 di Jeep

Sr. No	Parameter	Value
1	Gross vehicle weight	2150 Kg
2	Wheelbase(b)	2680 mm
3	Max speed	90 Km/hr
4	Engine	MDI3000
5	Type	Four stroke over square, Four cylinder inline
6	Weight of engine	275 kg
7	Turning circle Radius	60 m
8	Suspension	Front and Rear: Semi Elliptical leaf spring
9	Wheel, Rim, tyre	16× 6 inches
10	Track width	3 m

4.2 Calculation of load [5]

When jeep takes Right turn

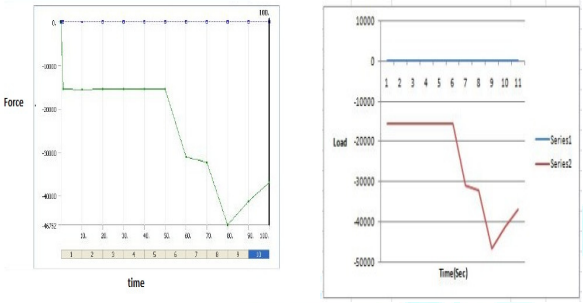
SR no	Parameter	Value
1	Load on Front wheel 1	4.402KN
2	Load on Front wheel 2	9.958KN
3	Load on Rear wheel 1	0.587KN
4	Load on Rear Wheel 2	6.143KN

When Jeep takes Reverse Direction

SR No	Parameter	Value
1	Load on Front Wheel 1	10.078KN
2	Load on Front Wheel 2	4.522KN
3	Load on Rear wheel 1	6.023KN
4	Load On Rear Wheel 1	0.467KN

5 TRANSIENT ANALYSIS OF A LEAF SPRING

5.1 When Jeep Takes Right Turn[6]



Ansys Result Analytically Result

Fig no 2 Time V/S Force Diagram

Step	Time	X[N]	Y[N]	Z[N]
1	0	0	0	0
	1	0	-15525	0
	10	0	-15582	0
2	20	0	-15526	0
3	30	0	-15527	0
4	40	0	-15525	0
5	50	0	--15525	0
6	60	0	-31050	0
7	70	0	-32328	0
8	80	0	-46752	0
9	90	0	-41363	0
10	100	0	-36925	0

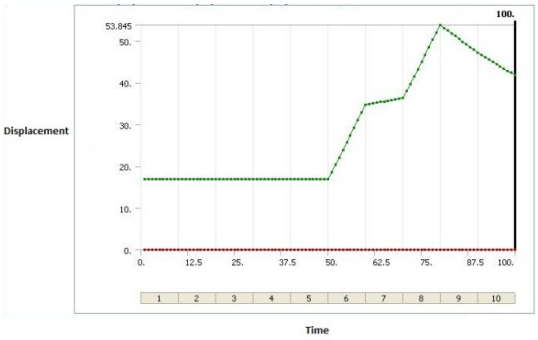
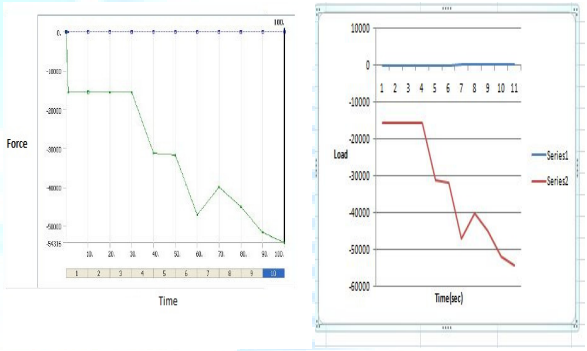


Fig no 3. Time V/S Displacement Diagram

5.2 When Jeep Takes Reverse Direction[6]



Ansys Result Analytically Result

Fig 4. Time V/S Force Diagram

Step	Time(sec)	X[N]	Y[N]	Z[N]
1	0	0	0	0
	1	0	-15585	0
	10	0	-15585	0
2	20	0	-15586	0
3	30	0	-15590	0
4	40	0	-31175	0
5	50	0	-31859	0
6	60	0	-47092	0
7	70	0	-39970	0
8	80	0	-45079	0
9	90	0	-51762	0
10	100	0	-54316	0

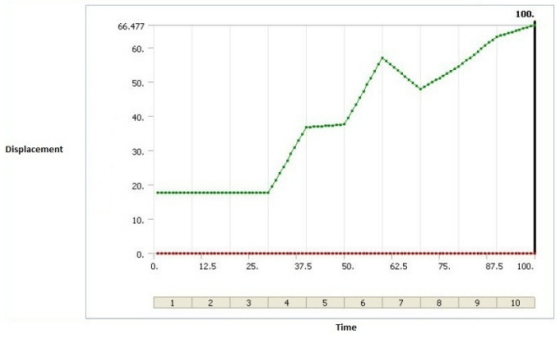


Fig no 5. Time V/S Displacement Diagram

3. CONCLUSIONS

When Jeep Takes Right turn Load Will Steady state Between o to 50 sec. Load Will be Decrease Between 50 to 80 sec. Load will increase Between 80 to 100sec.

When Jeep Takes Reverse Direction Load Will Steady State Between 0 to 30 sec. Load will be Decrease 30 to 60sec. Load will increase at 70 sec. Load Will decrease Between 80 to 100 sec.

4.References

[1].G.Harinath Gowd,E Venugopal Gowd, "Static Analysis of leaf spring", International of engineering Science and technology**.**

[2].www.autodata.net

[3]Krishan Kumar, M.l.Aggarwal ," Computer aided FEA Simulation of EN45 A Parabolic Leaf spring", International Journal of Industrial Engineering Computation.

[4].Dr.Sandhu Singh, Design of Machine Elements (Machine Design), Fifth edition, Khanna Publisher Company, New Delhi-110002.

[5].Dr.N.K. Giri, Automobile Mechanics, Eighth edition, Khanna Publishers company, New Delhi-110002.

[6].S.O.Connel,E.Abbo,K.Hedrick "Analysis of moving Dynamic load on Highway payments :Part 1-vehiclae response."