ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

COMPARATIVE STUDY OF COIL SPRING AND WAVE SPRING-A REVIEW

Mr. S. R. Patil[*], P.S.Talmale
P.G. Student[1], Assistant Professor[2]
Department of Mechanical Engineering, KCT's Late G. N. Sapkal College of Engineering, Management Studies And Research, Nashik.

ABSTRACT

Wave springs are precise flat wire compression springs that fit into assemblies that other springs cannot since the overall lengths and operating heights of Wave springs are lower than those of conventional round Wire springs, they will often reduce the size of an assembly by as much as 50%. Of course, this will also reduce the part weight and raw material cost of every spring produced. The objective of this paper is to update its readers the various spring analysis techniques. These methods use "theoretical finite element analysis techniques, together with experimental results, to detect stress, deflection and life of spring in different types of springs like helical compression spring, leaf spring. An analysis of these springs makes it possible to determine the life of spring. The objective of this study is to perform structural analysis of wave spring using different materials by theoretical and numerical methods.

KEYWORDS: Wave spring, FEA, deflection, helical compression spring, leaf spring,structural analysis.

INTRODUCTION

Springs are mainly used in the industry as members absorbing shock energy as well as for restoring the initial position of a part upon displacement for initiating a given function. 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. In other words it is also termed as a resilient member. Springs are elastic bodies (generally made up of metals) that can be twisted, pulled, or stretched by some force. A spring is a flexible element used to exert a force or a torque and, at the same time, to store energy. Among the many types of springs, wave springs have attracted considerable attention this kind of long and reliable source of long lasting durability and considerable effectiveness than rest of the springs.

ANALYSIS FOR SUSPENSION SPRING TO DETERMINE AND IMPROVE ITS FATIGUE LIFE USING FINITE ELEMENT METHODOLOGY

.Mr. Chandrakant Chavan [1] has presented the method to determine the fatigue life of the existing coil spring on the car and identify areas of improvement over the fatigue life. Finite Element Analysis deployed for the structural analysis using NASTRAN predicted using `MSC Fatigue'. For this work, experimentation performed for validating the performance parameter identified as `Stiffness' of the spring. The load vs. displacement recorded using load cells with data logger to display results. The results of Experimental work are compared for results with the numerical methodology and vice-versa. This paper shows that the Fatigue life analysis of the suspension coil spring using a FEA technique interface would offer credible design inputs which can be usComparison of Cylindrical and Conical Helical Springs for their Buckling Load and Deflection concurrently while designing the spring.

COMPARISON OF CYLINDRICAL AND CONICAL HELICAL SPRINGS FOR THEIR BUCKLING LOAD AND DEFLECTION

Rajkumar V. Patil [2] has proposed an analytical buckling equation with its experimental verification and used it along with the existing theories to locate the phase of compression of conical spring at which buckling occurs. Subsequently, a comparison between cylindrical and conical springs has been made at the point of buckling of cylindrical spring in respect of their load and deflection. This helps to decide the suitability of conical springs against buckling failure of cylindrical springs under the given operating conditions. The conical helical springs are

more useful than cylindrical for greater axial deflections without buckling. However, space constraints would restrict using conical springs. This analysis will help the designer to decide the suitability of conical springs for their replacement to avoid buckling of cylindrical springs. The newly developed equation for conical spring can be used to predict the buckling of conical spring beforehand. The conical springs are more useful where the variable stiffness is required especially in automobile systems.

DESIGN AND ANALYSIS OF COMPOSITE LEAF SPRING IN LIGHT VEHICLE

M.VENKATESAN et al. [3] has describes design and experimental analysis of composite leaf spring made of glass fiber reinforced polymer. The objective was to compare the load carrying capacity, stiffness and weight savings of composite leaf spring with that of steel leaf spring. The dimensions of an existing conventional steel leaf spring of a light commercial vehicle are taken. Same dimensions of conventional leaf spring are used to fabricate a composite multi leaf spring using E- Glass/Epoxy unidirectional laminates. Static analysis of 2-D model of conventional leaf spring is also performed using ANSYS 10 and compared with experimental results. Finite element analysis with full load on 3-D model of composite multi leaf spring is done using ANSYS 10 and the analytical results are compared with experimental results. Compared to steel spring, the composite leaf spring is found to have 67.35% lesser stress, 64.95% higher stiffness and 126.98% higher natural frequency than that of existing steel leaf spring. A weight reduction of 76.4% is achieved by using optimized composite leaf spring. The 3-D modelling of composite leaf spring is done and analysed using ANSYS. A comparative study has been made between composite and steel leaf spring with respect to weight, cost and strength. From the results, it is observed that the composite leaf spring is lighter and more economical than the conventional steel spring with similar design specifications. Composite leaf spring reduces the weight by 85 % for E-Glass/Epoxy, over conventional leaf spring.

DESIGN, ANALYSIS AND EXPERIMENTAL VALIDATION FOR FATIGUE BEHAVIOR OF A HELICAL COMPRESSION SPRING USED FOR A TWO WHEELER HORN

Mr. J. J. Pharne et al. [4] has proposed a finite element model for helical compression springs subjected to cyclic loads is developed for fatigue stress analysis. In the design modification of this kind of spring both the elastic characteristics and the fatigue strength have to be considered as significant aspects. A typical helical compression spring used for two wheeler horn is chosen for study under fatigue loading condition. Fatigue analysis is done in ANSYS 14.0 software. The results developed have been compared with the experimental observations. The results show that there was a permanent deformation of the modified spring by 0.74 mm and the maximum fatigue life was up to 106 cycles. These theoretical predictions are found to be acceptable. The modified spring was manufactured and tested as described. The experimental results show that at the end of 3 lakh cycles, no cracks or breakages were found in any of the five modified springs under experimental investigation.

DETERMINATION OF BUCKLING LOADS OF WAVE SPRING USING ANSYS

Dr P. Ravinder Reddy et al. [5] has present work on the structural analysis of wave and coil spring by modeling the structural behavior of these springs using three dimensional finite elements (FE) software. The design of spring in suspension system is very important. In this work a wave type of spring is designed and a 3D model is created using CREO software. The model is also varied by changing the length of the spring. Structural analysis has been conducted on the wave spring by varying thickness and number of turns. For the analysis, loads are bike weight with single and two persons. The buckling load is then estimated for both Wave spring and coil spring with the same parameters.Analysis on wave spring has been done by structural mechanics approach and results were validated and compared with the coil spring of the shock absorber. The deflection induced in the wave spring is average 25.88% less than the coil spring. The equivalent stress of wave spring is an average 58.32% less than coil spring. The strain energy of wave spring is an average 21.3% greater than coil spring. The strain energy increases with increase in torque and it is an average 60% greater in wave spring compared to coil spring. The buckling factor in wave spring is an average 26% greater than coil spring is obtained using this technique.

ANALYSIS AND TESTING OF TWO WHEELER SUSPENSION HELICAL COMPRESSION SPRING

C.Madan Mohan Reddy et al. [6] has carried out work on modelling, analysis and testing of suspension spring is to replace the existed steel helical spring used in popular two wheeler vehicle. The stress and deflections of the helical

spring is going to be reduced by using the new material. The comparative study is carried out between existed spring and new material spring. In this the finite element analysis values are compared to the experimental values. A typical two wheeler suspension spring is chosen for study. The modelling of spring is developed on pro/E 5.0 analysis is carried out on ANSYS 14. The maximum shear stress of chrome vanadium steel spring has 13-17% less with compare to hard drawn steel spring. The deflection pattern of the chrome vanadium steel spring 10%less at specified weight with compare to the hard drawn steel spring. It is observed that 95% of the similarity in deflection pattern and 97% similarity in shear stress pattern between experimental values to the analytical values.

CONCLUSION

By the literature review it is seen that, compare with previous old systems, this method propose modelling of wave spring is using Pro/engineer. Structural analysis has been conducted on the wave spring by varying the spring material such as Structural steel, brass and Beryllium copper. For this analysis, loads are considered as bike weight, single person and two person .Structural analysis is done to validate the strength. The present study makes an attempt to compare the result for selecting best material for springs.

REFERENCES

1. Chandrakant Chavan, “Analysis For Suspension Spring To Determine And Improve Its Fatigue Life Using Finite Element Methodology,” International Journal Of Scientific Research And Management Studies (Ijsrms) Issn: 23493771, Volume 1 Issue 11, Pg: 352-362 Dec 2013.
2. Rajkumar V. Patil1,” Comparison of Cylindrical and Conical Helical Springs for their Buckling Load and Deflection” International Journal of Advanced Science and Technology Vol.73 (2014), pp.33-50
3. M.Venkatesan,” Design And Analysis Of Composite Leaf Spring In Light Vehicle” International Journal Of Modern Engineering Research .Vol.2, Issue.1, Jan-Feb 2012 Pp-213-218 Issn: 2249-6645.
4. Mr. J. J. Pharne1,” Design, Analysis And Experimental Validation For Fatigue Behavior Of A Helical Compression Spring Used For A Two Wheeler Horn”, Iosr Journal Of Mechanical And Civil Engineering (Iosr-Jmce) E-Issn: 2278-1684,P-Issn: 2320-334x, Volume 11, Issue 6 Ver. Iii (Nov- Dec. 2014), Pp 05-11\
5. Dr P. Ravinder Reddy,” Determination of Buckling Loads of Wave Spring Using ANSYS”, International Journal of Research in Engineering and Science (IJRES) ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
6. C.Madan Mohan Reddy,” Analysis And Testing Of Two Wheeler Suspension Helical Compression Spring” IOSR Journal Of Engineering (IOSRJEN) ISSN (E): 2250-3021, ISSN (P): 2278-8719 Vol. 04, Issue 06 (June. 2014), ||V1|| PP 55-60
7. Meghavath. Peerunaik,” Static and Modal Analysis of Leaf Spring using FEA”, International Journal of Computational Engineering Research||Vol, 03||Issue, 4||

ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

AUTHOR BIBLIOGRAPHY

	Mr. Patil S. R. is student of M .E .MECHANICAL (DESIGN) of KCT's Late G.N.Sapkal Collage of Engineering ,Nashik. Maharastra. He completed his B.E. In Mechanical Engineering in 2014.Her interesting subject is vibration and automobile
	Ms.P. S. Talmale is assistant professor at KCT's Late G.N.Sapkal Collage of Engineering. She completed her B.E. In Mechanical Engineering in 2004 from Umrer college of engineering, Nagpur, then after she completed her Post Graduation in ME (cadcam). Her interesting subject is FEA