International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 5, July-August 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Analysis of Mechanical Behavior of Composite Material Carbon Fiber using Structural Strength Analysis on Shock Absorber using ANSYS Structural

Anand Kumar Jaiswal[1], Sandeep Kumar Sharma[2]

[1]MTech Research Scholar, [2]Assistant Professor,
[1,2]Dr. C V Raman University, Bilaspur, Chhattisgarh, India

ABSTRACT
In this investigation article, we expected to get the information on mechanical conduct of composite material carbon fiber utilizing a 3D model of shock absorber. For this reason we have concentrated such a large number of creators to get the boundaries which influence the exhibition of shock absorber. We found that components and boundaries, for example, Coil material of shock absorber Construction and size of the shock absorber, Mechanical properties of shock absorber, Optimization strategies for shock absorber suspension framework, Innovative plan of shock absorber are the boundaries which can be advanced for improving aftereffects of auxiliary execution upgrade of shock absorber. Following the survey procedure we demonstrated a 3d math of shock absorber in CATIA V5 and performed auxiliary investigation on ANSYS 14.0. we discovered by arrangement of the examination that carbon fiber is reasonable for assembling of shock absorber since we got less complete twisting for carbon fiber when contrasted and the ordinary material of shock absorber for example spring steel . The estimations of stresses and strains were seen as ideal also. These all added to expand the basic execution of shock absorber by utilizing composite material carbon fiber.

KEYWORDS: *Mechanical behavior, Composites Materials, Structural Analysis, Shock Absorber, ANSYS structural*

How to cite this paper: Anand Kumar Jaiswal | Sandeep Kumar Sharma "Analysis of Mechanical Behavior of Composite Material Carbon Fiber using Structural Strength Analysis on Shock Absorber using ANSYS Structural" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-5, August 2020, pp.1571-1575, URL: www.ijtsrd.com/papers/ijtsrd33188.pdf

IJTSRD33188

1. INTRODUCTION

Shock absorbers are used in conjunction with cushions and springs. An automobile shock absorber contains spring-loaded check valves and orifices to control the flow of oil through an internal piston. In a vehicle, shock absorbers reduce the effect of traveling over rough ground, leading to improved ride quality and vehicle handling. While shock absorbers serve the purpose of limiting excessive suspension movement, their intended sole purpose is to damp spring oscillations. Shock absorbers use valving of oil and gasses to absorb excess energy from the springs. Spring rates are chosen by the manufacturer based on the weight of the vehicle, loaded and unloaded. Some people use shocks to modify spring rates but this is not the correct use. Along with hysteresis in the tire itself, they damp the energy stored in the motion of the unsprung weight up and down. Effective wheel bounce damping may require tuning shocks to an optimal resistance.

Spring-based shock absorbers commonly use coil springs or leaf springs, though torsion bars are used in torsional shocks as well. Ideal springs alone, however, are not shock absorbers, as springs only store and do not dissipate or absorb energy. Vehicles typically employ both hydraulic shock absorbers and springs or torsion bars. In this combination, "shock absorber" refers specifically to the hydraulic piston that absorbs and dissipates vibration. Now, composite suspension systems are used mainly in 2 wheelers and also leaf spring are made up of composite material in 4 wheelers.[1]

2. Geometry

The figure shown below is a 3d model of shock absorber made with -

- Case1) Spring Steel
- Case2) Carbon Fiber

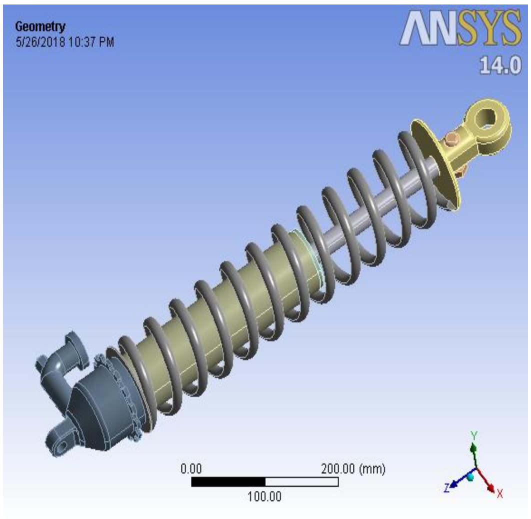

Fig.2.1 3D Geometry of shock absorber

3. Meshing

The figure shown below shows the meshing of shock absorber geometry made with

- Case1) Spring Steel
- Case2) Carbon Fiber

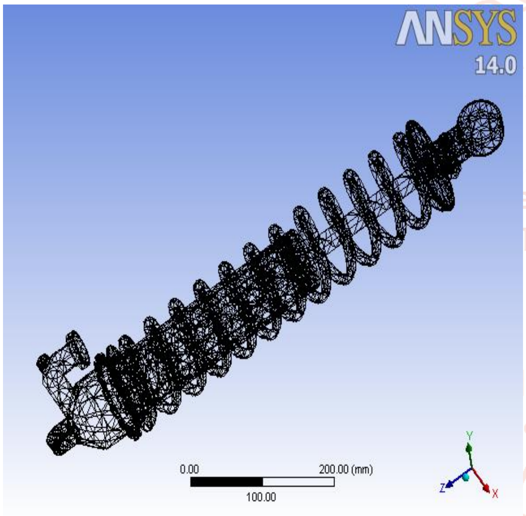

Fig.3.1) Wireframe Meshing of Shock Absorber

4. Solver setup

The following figures show the setup for solution in the Ansys 14.0.

- Case1) Spring Steel
- Case2) Carbon Fiber

The figure shown below shows the fixed support applied at bottom end.

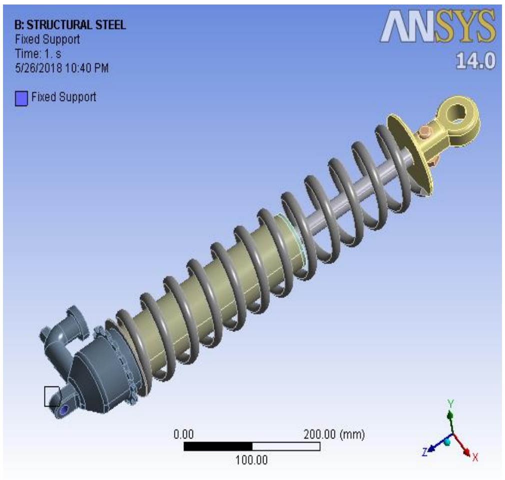

Fig.4.1) Fixed support at bottom end

The figure shown below shows the application of 1200N tensile force at the top end

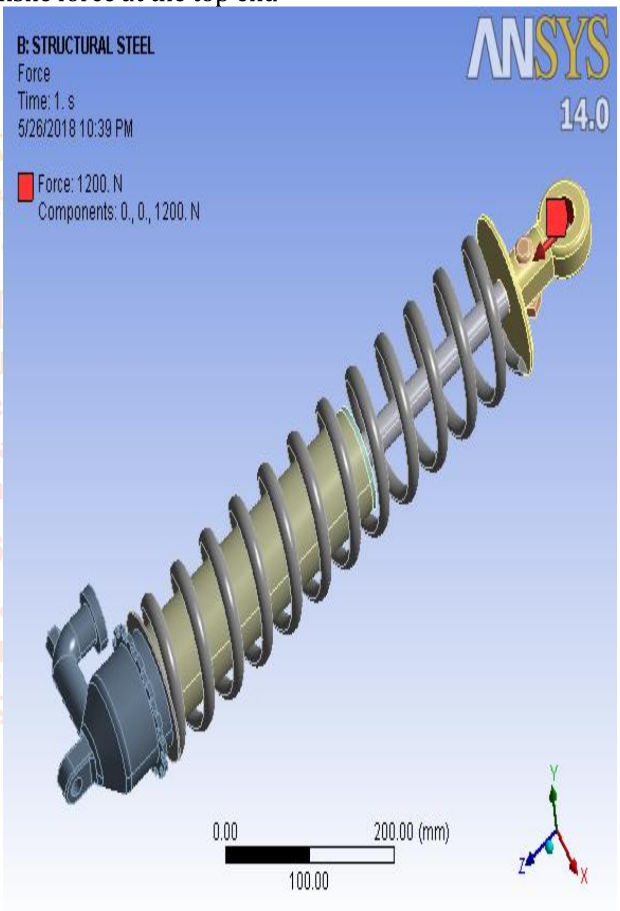

Fig.4.2) Tensile force at top end

Table 4.1) Details of Material Properties

properties→ material name↓	Density (g/cm³)	Modulus of Elasticity (GPa)	Poisson ratio	Tensile Strength(MPa)
Spring Steel	7.85	200	0.3	460
Carbon Fibre	1.8	230	0.3	4900

Table 4.2) details of loads and supports

Object Name	Fixed Support	Force
State	Fully Defined	
Scope		
Scoping Method	Geometry Selection	
Geometry	1 Face	

Definition		
Type	Fixed Support	Force
Suppressed	No	
Define By		Components
Coordinate System		Global Coordinate System
X Component		0. N (ramped)
Y Component		1200 N (ramped)
Z Component		0. N (ramped)

5. Results

The figures shown below are the contour graph of results of analysis for equivalent stress (Von -Mises) and total deformation

➢ **Case1) spring steel**

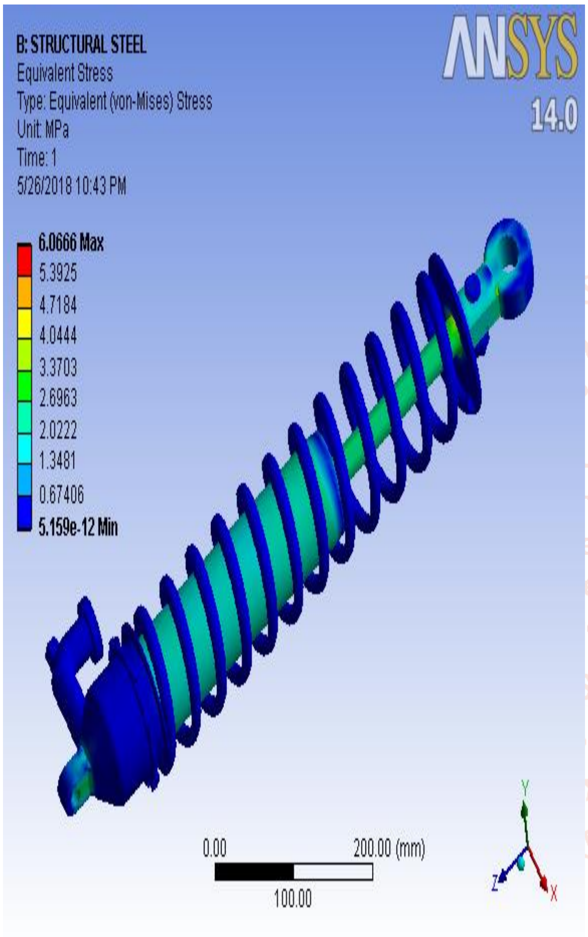

Fig.5.1) Equivalent stress for spring steel

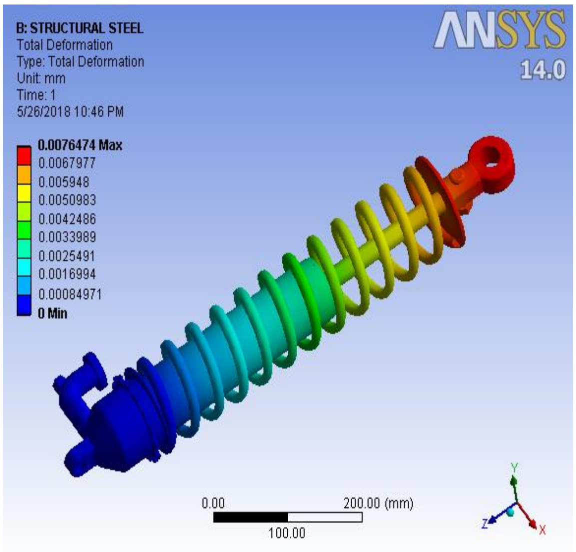

Fig.5.2) Total Deformation for spring steel

➢ **Case3) Carbon fiber**

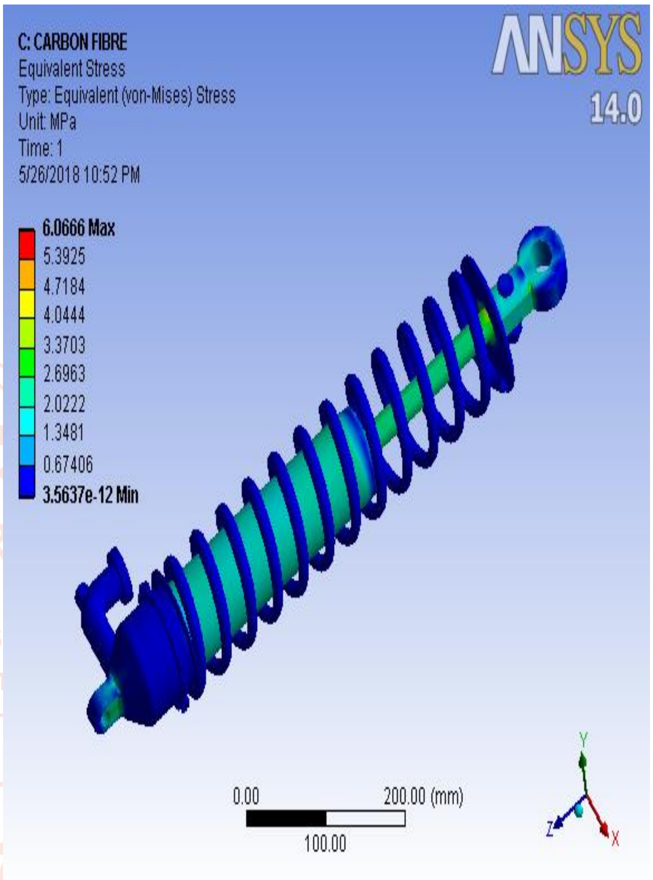

Fig.5.5) Equivalent stress for Carbon Fiber

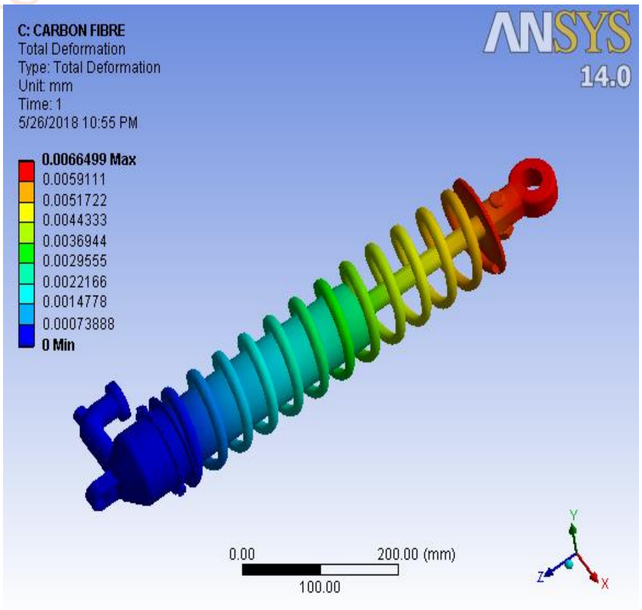

Fig.5.6) Total Deformation for carbon fiber

Table 5.1) solution results of all the materials for equivalent stress von mises and total deformation

Name of material→ solution↓	Spring steel	Beryllium	Carbon fiber
Equivalent stress (MPa)	6.0666	6.3783	6.0666
Total deformation(mm)	0.0076474	0.0051135	0.0066499

Conclusion

The structural performance of shock absorber was analyzed by a comparative study using conventional material of shock absorber i.e. spring steel and materials which is namely as beryllium and carbon fiber. The structural analysis was done using ANSYS fluent 14.0. It is concluded that composite materials carbon fiber and beryllium have lower value of total deformation when compared to conventional material of shock absorber which leads to high structural strength of shock absorber. It is also concluded that the values of equivalent stresses and equivalent strains are also optimum for carbon fiber and beryllium. So the enhancement of structural strength of shock absorber is achieved using carbon fiber and beryllium.

REFERENCES

[1] Prince Jerome Christopher J. &Pavendhan R. "Design and Analysis of Two Wheeler Shock Absorber Coil Spring", *International Journal of Modern Engineering Research, page no 133-140.*

[2] VittoreCossalter, Alberto Doria, Roberto Pegoraro& Luca Trombetta, "Testing And Modelling Of An Advanced Motorcycle Shock Absorber", *Proceedings Of The ASME 2010 10th Biennial Conference On Engineering Systems Design And Analysis ESDA*2010 Istanbul, Turkey july 12-14, 2010.

[3] Mr. Anirudh M. Shende, Prof. Shirish N. Gandhare& Dr. S. P. Untawale, "Failure Analysis Of Helical Coil Spring In Automobile System Using Finite Element Method", *International Journal of Research In Science & Engineering,* Volume 2 Issue 5.

[4] SomnathJagtap, "The Probabilistic Design Approach To Heical Coil Spring Using Ansys PDS", *International Research Journal Of Multidisciplinary Studies,*Vol. 2, Special Issue 1, March, 2016.

[5] Anil Agarwal&Vaibhav Jain, "Design And Analysis Of Helical Spring In Two Wheeler Suspension System Using Finite Element Method", *International Research Journal of Engineering and Technology,* Volume: 04 Issue: 09 Sep -2017

[6] RutujaDeshmukh, SumantPatil & AmolKokare, "Optimization of Shock Absorber Parameters by Using DOE and Validation by MATLAB Software", *International Advanced Research Journal in Science, Engineering and Technology,* Vol. 4, Issue 9, September 2017.

[7] W H Tan, J X Cheah, C K Lam, E A Lim, H G Chuahand& C Y Khor, "Vibration analysis on compact car shock absorber", *Journal of Physics: Conf. Series*908,2017.

[8] M. Kamal and M. M. Rahman, "Finite Element-Based Fatigue Behaviour Of Springs Inautomobile Suspension", *International Journal of Automotive and Mechanical Engineering*, Volume 10, pp. 1910-1919, July-December 2014.

[9] Muhammad Zahir Hassan, MohdKamarulHafis Abdul Aziz &Frank Delbressine and Matthias Rauterberg, "Numerical Analysis of Spring Stiffness in Vehicle Design Development Stage", *International Journal of Applied Engineering Research,* Volume 11, Number 7 (2016) pp 5163-5168.

[10] SagarNamdevKhurd, Prasad P. Kulkarni and S. D. Katekar, "New Design Approach of Helical Coil Spring for Longitudinal and Translational Invariance by Using Finite Element Analysis", *Springer International Publishing*, AG 2018.

[11] FadiAlkhatib and Anoop K. Dhingra, "Dynamic Analysis and Design of Motorcycle Mounting System Subjected to Road Loads", *IJRE*, Vol. 03 No. 08, August 2016.

[12] Dr. Dhananjay. R. Dolas, Kuldeep. K. Jagtap, "Analysis of Coil Spring Used in Shock Absorber using CAE", *International Journal of Engineering Research*, Volume No.5, Issue No.2, pp: 123- 126.

[13] Vijay Barethiye, G. Pohit & A. Mitra, "A combined nonlinear and hysteresis model of shock absorber for quarter car simulation on the basis of experimental data", *Engineering Science and Technology, an International Journal*, (2017).

[14] P. Mohan, K. V. Poornachandran, P. Pravinkumar, M. Magudeswaran & M. Mohanraj, "Analysis of Vehicle Suspension System Subjected to forced Vibration using MATLAB/Simulink", *IJIRST, National Conference on Recent Advancements in Mechanical Engineering (RAME'17) March* 2017.

[15] S. Gopinath, R. J. Golden Renjith & J. Dineshkumar, "Design and Fabrication of Magnetic Shochk Absorber', *International Journal of Engineering and Technology*, 3 (2), 208-211, 2014.

[16] P. N. L. Pavani, B. K. Prafulla, R. PolaRao & S. Srikiran, "Design, Modeling and Structural Analysis of Wave Springs", *3rd International Conference on Materials Processing and Characterisation*, ICMPC ,2014.

[17] Ashish M. Choube, Ravikant V. Paropate, Manish S. Hajare, Sagar P. Lakhani, Sujit P. Khairkar&Shanu S. Indurkar, " Stress Analysis Of Mono Suspension Spring", *International Journal Of Innovative Technology And Research* Volume No.2, Issue No. 2, February – March 2014, 785 - 787.

[18] Asst. Prof. N. Vivekanandan, AbhilashGunaki, ChinmayaAcharya, Savio Gilbert And RushikeshBodake, "Design, Analysis And Simulation of Double Wishbone Suspension System", *IPASJ International Journal of Mechanical Engineering,* Volume 2, Issue 6, June 2014.

[19] MarnishModi, Krishna Dave & DipenModi, "Review Paper Of Design And Analysis Of Two Wheeler Vehicles Rear Shock Absorber", *International Journal For Research In Applied Science & Engineering Technology (IJRASET), Volume 2 Issue Xi, November 2014.*

[20] Vishal Chaudhari and Prof. G. V. R. S. Rao, "Structural Analysis of Helical Compression Spring", *IJSRSET*, Volume 2 Issue 4 2016.

[21] ShidaNie, Ye Zhuang, Yong Wang &KonghuiGuo. "Velocity & displacement-dependent damper: A novel passive shock absorber inspired by the semi-active control", *Mechanical Systems and Signal Processing* 99 730–746, 2018.

[22] Ragupathi. P, Dhayanidhi. E, Arunachalam. S, Jegadeshwaran A & Kamal Hassan. P, "Design of Helical Spring Suspension", *Imperial Journal of Interdisciplinary Research (IJIR)* Vol-3, Issue-4, 2017.

[23] Manoj A. Kumbhalkar, Dr. D. V. Bhope& Dr. A. V. Vanalkar, "Material and Stress Analysis of Railroad Vehicle Suspension: AFailure Investigation", *Procedia Materials Science*, 10 331 – 343, 2015.

[24] Dr. A. Gopichand, Ch. Harish Kumar, B. Mahesh Krishna & D. BhanuPrakash, "Static Structural and Fatigue Analysis of Two Wheeler Shock Absorber", *International Journal of Emerging Trends in Science and Technology,* Vol 01, Issue 10, Pages 1627-1633, December, 2014.

[25] G. R. Chavhan, S. W. Burande & Dr. L. P. Dhole, "Analysis Of Shock Absorber Using Different Material Of Spring", *International Journal Of Advanced Engineering Technology*, Vol. V/Issue Iv/Oct.-Dec.,2014.

[26] MarnishModi, SalehaShaikh & Prof. A. N. Shayani, "Design and analysis of two wheeler vehicles rear shock absorber by using composite E glass Epoxy material", *International Journal Of Engineering Innovation And Scientific Research*,Vol.1 (1)-P.P-01-06, 2016.

[27] Suraj R. Bhosle, Shubham R. Ugle& Dr. Dhananjay R. Dolas, "Comparative Analysis of Suspension System Coil Spring Using FEA", *Imperial Journal of Interdisciplinary Research (IJIR),* Vol-3, Issue-1, 2017.

[28] H. Deng, Haiping Du, Weihua Li &GurselAlici, "A Compact Variable Stiffness and Damping Shock Absorber for Vehicle Suspension", IEEE/ASME *Transactions on Mechatronics*, 2015.

[29] Rahul Tekade&ChinmayPatil, "Structural and Modal Analysis of Shock Absorber Of Vehicle", *International Journal Of Engineering Trends And Technology (IJETT)* – Volume 21 Number 4 – March 2015.

[30] Ch. Ramakrishna, N. Sivateja, S. Rajashekar and P. BhaskarRao, "Typical Experimental Design & Testing of Model MR Damper using Helical coiled spring", International Journal of Current Engineering and Technology, Vol.7, No.2, April ,2017.

[31] *Frederick T. Wallenberger; Paul A. Bingham (October 2009).* Fiberglass and Glass Technology: Energy-Friendly Compositions and Applications*. Springer. pp. 211–.* ISBN 978-1-4419-0735-6*. Retrieved 29 April 2011.*