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# ANALYSIS OF ANTI-ROLL BAR OF PASSENGER CAR USING ALTERNATIVE MATERIAL

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## ABSTRACT

*Now a day's customer demands comfortable car. This is accomplished by influencing the motions affected by road irregularities to the wheels and axles while minimizing their effect on the vehicle body and frame. Anti-Roll Bar is used in suspension system to limit the body roll angle. They are useful to improve the handling characteristics of the vehicle. In this paper the Anti-Roll Bar is designed. The Nylon is considered as alternative material for Anti-Roll Bar. It is also compared with Mild steel properties. Reducing un-sprung weight has an effect on the fuel consumption. Hence alternative material for analysis of anti-roll bar is selected and justified. The modeling and analysis is done using CATIA and ANSYS.*

***Keyword*: -Anti-Roll Bar, ANSYS, Nylon, Torsional Stiffness, Suspension System.**

## I INTRODUCTION

All suspension systems have a common goal, which is to improve the ride in terms of comfort, handling and safety. This is accomplished by influencing the motions effected by road irregularities to the wheels and axles while minimizing their affect on the vehicle body and frame. A successful design would therefore incorporate (a) A High sprung-to-unsprung-mass-ratio, (b) A Mass-Spring-Damper system between the vehicle body and the wheels, and (c) An Anti-Roll Bar. Consequently, the wheels and axles endure the most of the motions caused by road irregularities while their effect is minimized on the vehicle body as desired. The main goal of using anti-roll bar in suspension system to limit the body roll angle. They are useful to improve the handling characteristics of the vehicle. The ends of the anti-roll bar are connected to the suspension links while the center of the bar is connected to the frame of the car such that it is free to rotate. The ends of the arms are attached to the suspension as close to the wheels as possible. If the both ends of the bar move equally, the bar rotates in its bushing and provides no torsional resistance. But it resists relative movement between the bar ends, the bar's torsional stiffness-or resistance to twist-determines its ability to reduce such relative movement. The effective spring rate of the bar is determined by its length, cross section, shape, material and manufacturing process. In doing so, the anti-roll bar provides a level of resistance to the forces generated by the movement of the vehicle. This resistance is the key principal behind an anti-roll bar. In this paper torsional stiffness of anti-roll bar is improved using alternative material [1][2].

## II ALTERNATIVE MATERIAL

Fiberglass is a type of fiber reinforced plastic where the reinforcement fiber is specifically glass fiber. The glass fiber may be randomly arranged but is commonly woven into a mat. The plastic matrix may be a thermosetting plastic-most often epoxy, polyester resin- or vinylester, or a thermoplastic.An individual structural glass fiber is both stiff and strong in tension and compression-that is, along its axis. Although it might be assumed that the fiber is weak in compression, it is actually only the long aspect ratio of the fiber which makes it seem so; i.e., because a typical fiber is long and narrow, it buckles easily. On the other hand, the glass fiber is weak in shear-that is, across its axis. Therefore, if a collection of fibers can be arranged permanently in a preferred direction within a material, and if they can be prevented from buckling in compression, the material will be preferentially strong in that direction. Furthermore, by laying multiple layers of fiber on top of one another, with each layer oriented in various preferred directions, the material's overall stiffness and strength can be efficiently controlled. In fiberglass, it is the plastic matrix which permanently constrains the structural glass fibers to directions chosen by the designer. With chopped strand mat, this directionality is essentially an entire two dimensional plane; with woven fabrics or unidirectional layers, directionality of stiffness and strength can be more precisely controlled within the plane[3].

Nylon is very much suitable for hosiery and the knitted fabrics because of its smoothness, light weight and high strength. Nylon is lustrous fiber. The luster of the fiber can be modified by adding the de blustering agent at the molten stage. The nylons are polyamides with recurring amide groups. They contain carbon, oxygen, nitrogen and hydrogen elements. Nylon has good tenacity and the strength is not lost with age. Nylon has a high strength to weight ratio. It is one of the lightest textile fibers is at the same time also one of the strongest. It is one of the fibers which are added at the points of wear such as knees, toes and heels of socks. The strength of the nylon fabric is lost when wet. Nylon has excellent abrasion resistance. Nylon has good elasticity which makes it much suitable for the apparel purposes. The excellent elasticity would mean that the nylon materials return to their original length and shreds the wrinkles or creases. Nylon like other fibers has its own limit of elasticity. Nylon recovers to its original shape. If stretched too much, it will not completely recover its shape. The high elongation and excellent elastic recovery of nylon contributes to the outstanding performance. Nylon fabrics have excellent resilience. The heat conductivity of the nylon fabrics vary depending upon the fabric construction, the type of nylon (staple/filament) used in the construction. Good machinability and less cost easy to replace are some of the advantages of nylon.

## III ANTI-ROLL BAR ANALYSIS

This topic focuses the work did in the software's for the analysis of the antiroll bar used in the vehicle. A Maruti Alto K10 model was used as the test vehicle to verify the results of the simulations. Nylon is used as alternative material for anti-roll bar with, anti-roll bar of nylon material has diameter 1.5 times diameter of anti-roll bar of mild steel material. The 3D model of the anti-roll bar is developed in the CATIA V5 R20 as depicted in fig.1. The model is developed after measuring the dimensions of the anti-roll bar in the 3D modeling environment. The boundary conditions and the constraints are applied on the model to simulate actual condition [4].

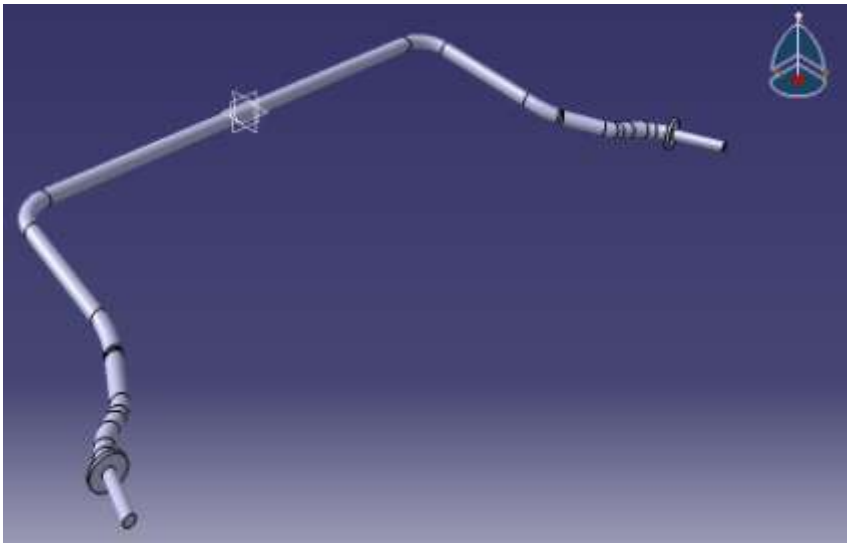

**Fig.1- 3D Modeling of Anti-Roll Bar**

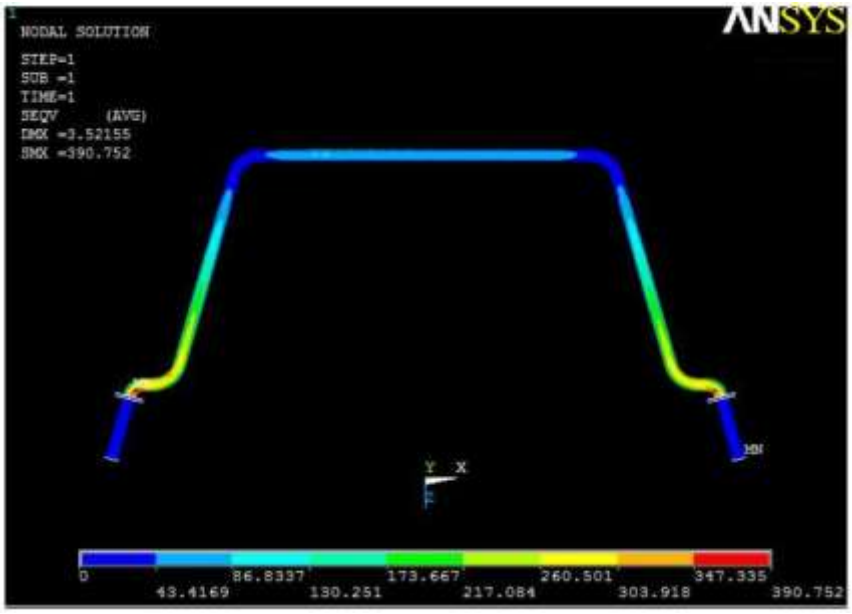


**Fig.2- Analysis of Anti-Roll Bar in ANSYS**

Fig. 2 depicts the finite element modal of the antiroll bar in ANSYS. For meshing 10 circumferential and 3 radial subsections are used for solid circular cross-section and extruded throughout axis of anti-roll bar. The bar will be meshed with BEAM189 elements. Anti-roll bar only is free to rotate in bushing. Therefore loads are applied at free ends of anti-roll bar to its relative moment.

## IV RESULTS

Fig. 3 and 4 shows torsion (N.mm) Vs. angular displacement (rad) graph of both anti-roll bar. Torque in both graph taken same and effect on angular moment are placed. The ANSYS analysis on anti-roll bar of mild steel of diameter of 22 mm. and effective length of 670 mm. is considered for the analysis. Quarter weight of car is

used for applying load on one end of anti-roll bar i.e. 1766 N is applied. The maximum angular displacement on rod is 0.175 rad and the results are shown on the Fig.3. The Fig.4 shows the ANSYS results for anti-roll bar of nylon of diameter 33 mm. Same load is applied on one end so maximum angular displacement on rod is 0.0875 rad. Hence it is justified that the Nylon can be used as anti-roll bar.

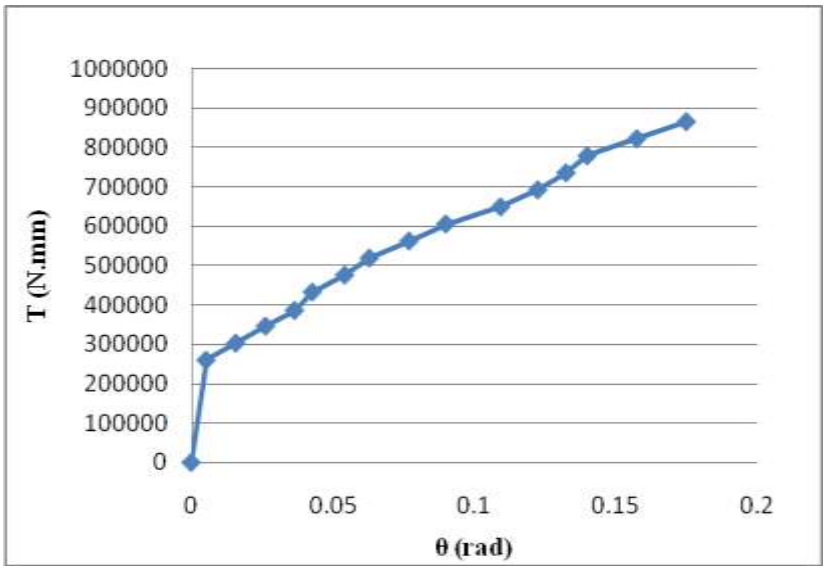


**Fig.3- Analysis on Mild Steel Anti-Roll Bar**

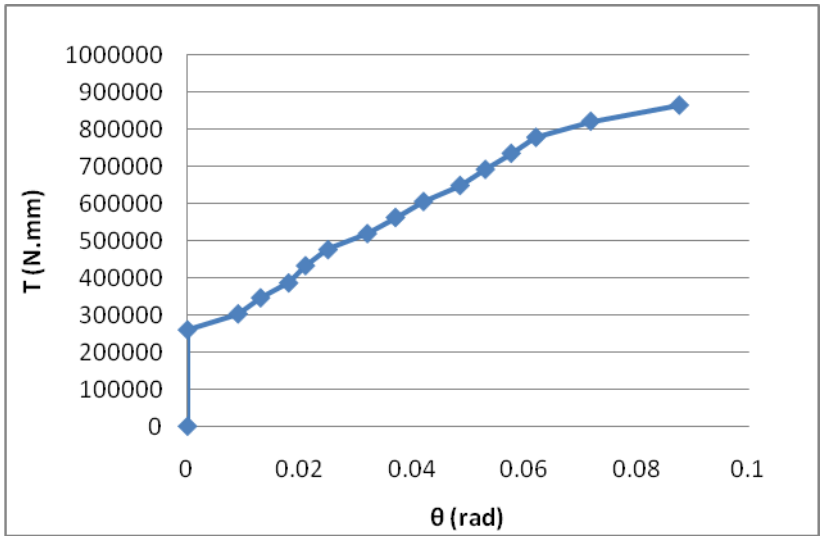


**Fig.4- Analysis on Nylon Anti-Roll Bar**

## V CONCLUSION

The ANSYS results of the anti-roll bar shows favorable results to select Nylon as alternative material for anti-roll bar. However in practice the anti-roll bar will not be rotated in rotation, it's only produce twisting effect. From ANSYS result it shows torsional stiffness of nylon anti-roll bar is higher than for M. S. , but M. S. is used due to cost and easy machinability. From analysis it is seen that though the diameter of nylon anti-roll bar is

increased, the angular deflection and weight decreases compare to M.S. anti-roll bar. This reduction in weight of the un-sprung mass of the vehicle also helps to reduces fuel consumption.

## REFERENCES

1]Kemal Caliskan, *Automated Design Analysis of Anti-Roll Bars*, Masteral Dissertation, The Graduate School of Natural And Applied Sciences, The Middle East Technical University, 2003.

2]M. Murat Topac, H. Eren EnginaR, N. Sefa Kuralay, Reduction of Stress Concentration at the Corner Bend of the Anti-Roll Bar by Using Parametric Optimisation, *Mathematical and Computational Applications, Vol. 16, No. 1, pp. 148-158, 2011.*

3] Filiz Civgin, *Analysis of Composite Bars in Torsion*,Masteral Dissertation, The Graduate School Of Natural And Applied Sciences,Dokuz Eylul University, 2005.

4]Yogesh Sharma, Analysis of Torsion Bar by the Finite Element Technique, *International Journal of Research in IT, Management and Engineering.Volume3, Issue6 ISSN: 2249-1619.*

5] Thomson Gillespie, *Fundamentals of Vehicle Dynamics*, (Society of Automobile Engineers, 1992)