A Study of Drive Shaft Assembly

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Abstract: -

The weight reduction of the driveshaft can have a certain role in the general weight reduction of the vehicle and is a highly desirable destination. Substituting composite structures for conventional metallic structures has many advantages because of higher specific stiffness and durability of composite materials. The advanced composite materials such as graphite, carbon, Kevlar and Glass with suitable resins are widely practiced because of their high specific strength and high specific modulus. Advanced composite materials seem ideally suited for long, power driver shaft applications. The automotive industry is exploiting composite material technology for structural component construction in order to obtain the reduction of the weight without a reduction in vehicle quality and dependability. It is known that energy conservation is one of the most important objectives in vehicle design and reduction of weight is one of the most efficient steps to get this effect. In reality, on that point is about a direct proportion between the weight of a vehicle and its fuel use, especially in city driving. This task is an analysis performed on drive shaft with different composite materials and concludes that the utilization of composite materials for drive shaft would induce less amount of stress which additionally reduces the weight of the vehicle. CATIA is the modelling package used to model the drive shaft arrangement and ANSYS is the analysis package used to carry out analysis.

Keywords: - ANSYS, CATIA, E-GLASS, E-CARBON, Kevlar.

I. INTRODUCTION

The automotive industry is exploiting composite material technology for structural component construction in order to obtain the reduction of the weight without a reduction in vehicle quality and dependability. The advanced composite materials such as Graphite, Carbon, Kevlar and Glass with suitable resins are widely practiced because of their high specific strength (intensity/density) and high specific modulus (modulus/density). Advanced composite materials seem ideally suited for long, power driver shaft (propeller shaft) applications. Their elastic properties can be tailored To increase the torque they can run as well as the rotational speed at which they work. The drive shafts are used in automotive, aircraft and aerospace applications. The automotive industry is exploiting composite material technology for structural component construction in order to obtain the reduction of the weight without a reduction in vehicle quality and Reliability. It is known that energy conservation is one of the most important objectives in vehicle design and reduction of weight is one of the most efficient steps to get this effect. In reality, on that point is about a direct proportion between the weight of a vehicle and its fuel use, especially in city driving.

II. ASSEMBLY OF DRIVE SHAFT ASSEMBLY USING CATIA

The sequence how the propeller shaft arrangement is met is discussed infra.

- CATIA V5 is opened and a new

assembly file is created by navigating in to its start menu.

- Existing part command in product structure tools toolbar is invoked and one of the previously prepared part design (say propeller shaft) is added and its placement is fixed using constrains position toolbar.
- Likewise all other components add one by one and assembled using the coincidence, offset and parallelism constraints in constrains position toolbar.
- This fills in the assembly of propeller shaft system of Toyota Qualis and is depicted in the image.

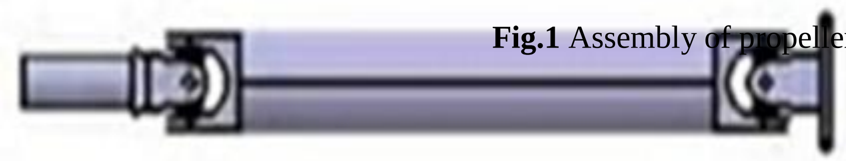
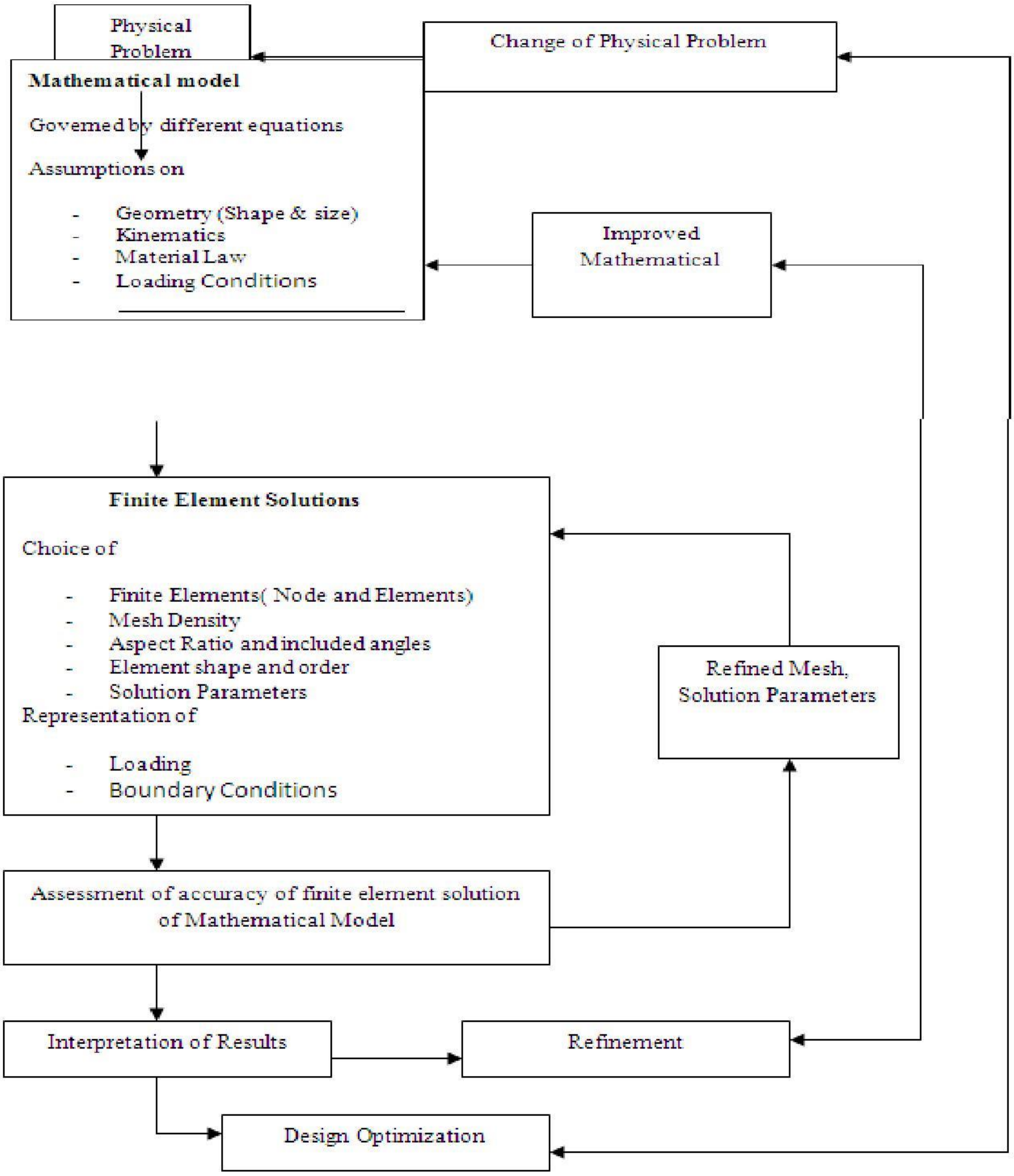


Fig.1 Assembly of propeller shaft

III. THE PROCESS OF F.E.A



IV. ANALYSIS OF DRIVE SHAFT ASSEMBLY UNSING ANSYS

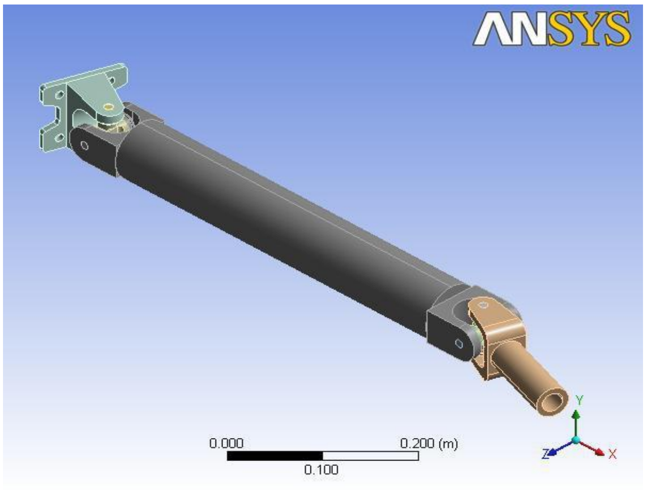


Fig.2 Imported Model Of Drive Shaft

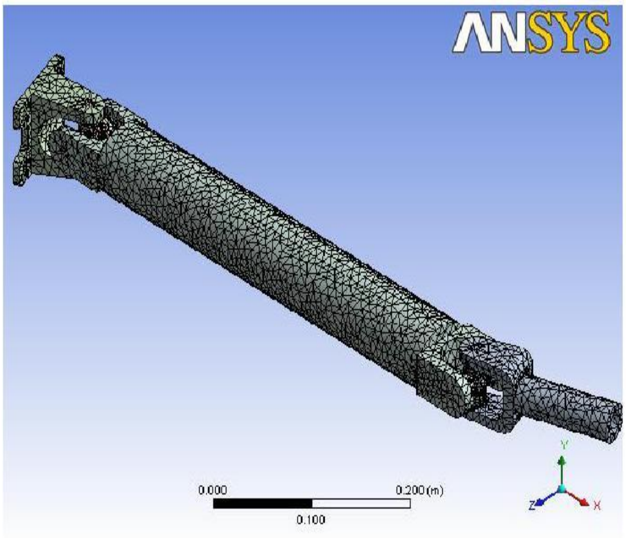
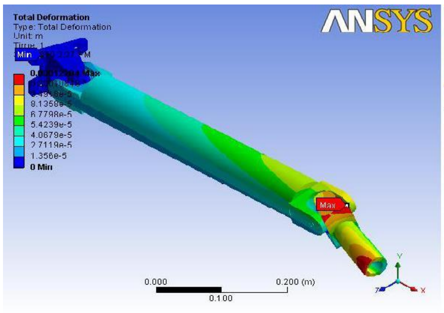


Fig.3 Meshing Of Assembly

V. RESULTS AND DISCUSSION

1. **STEEL:**



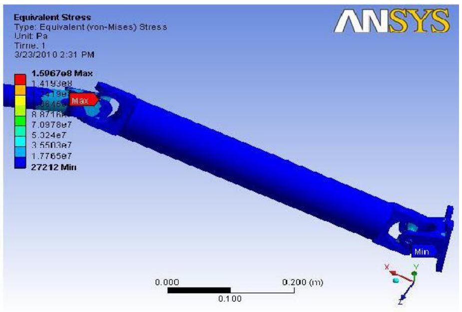
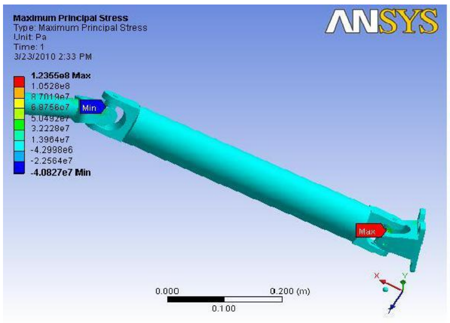


Fig.4 Total Deformation **Fig.5** Equivalent Stress (Von-Mises)



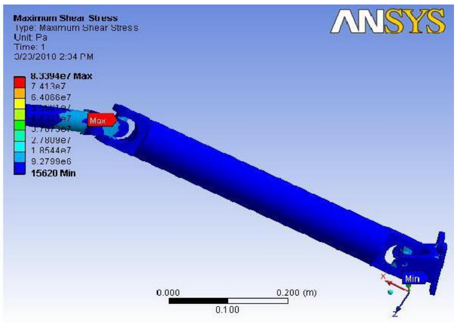
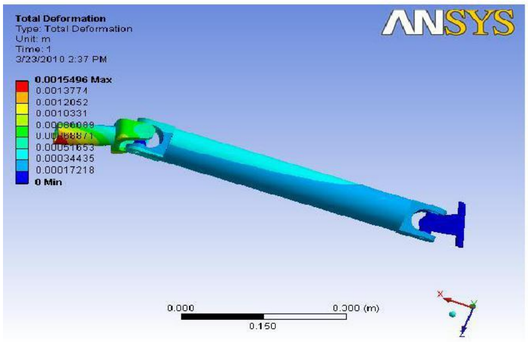


Fig.6 Maximum Principal Stress **Fig.7** Maximum Shear Stress

2. **E GLASS:**



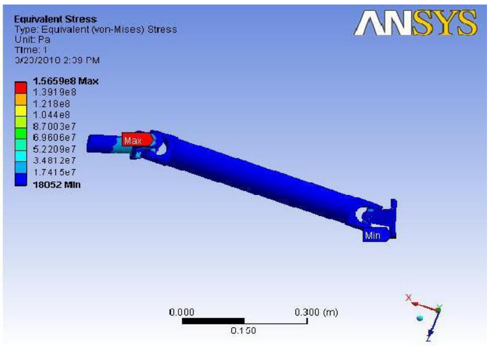
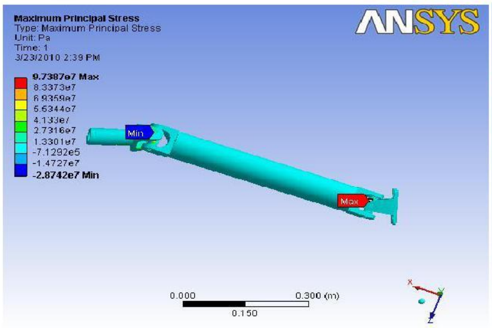


Fig.8 Total Deformation **Fig.9** Equivalent Stress (Von-Mises)



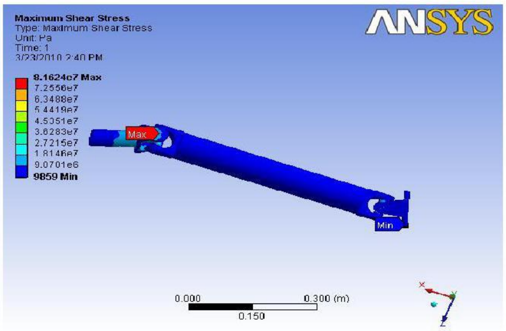
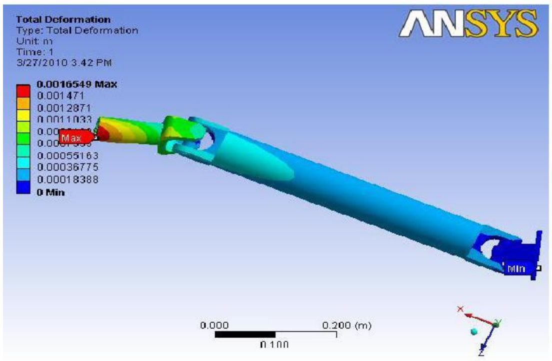


Fig.10 Maximum Principal Stress **Fig.11** Maximum Shear Stress

3. E CARBON:



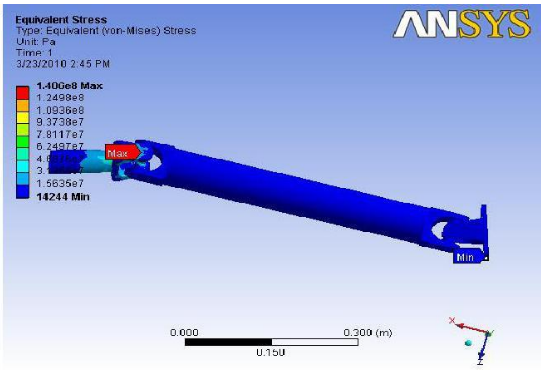
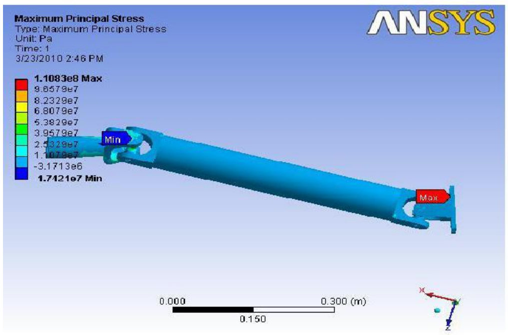


Fig.12 Total Deformation **Fig.13** Equivalent Stress (Von-Mises)



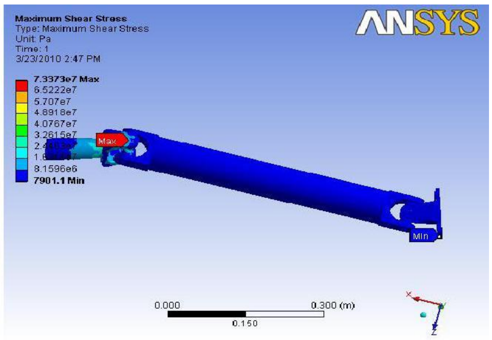
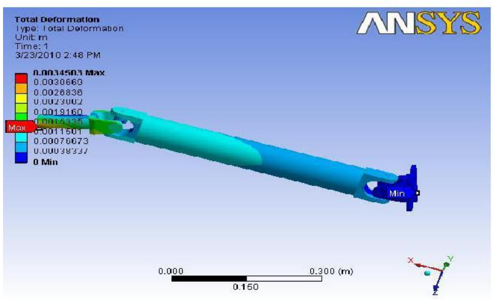


Fig.14 Maximum Principal Stress **Fig.15** Maximum Shear Stress

4. E-GLASS POLYESTER:



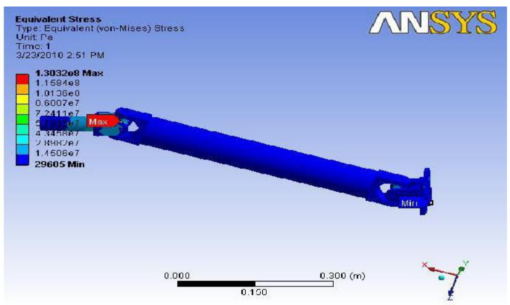


Fig.15 Total Deformation S) **Fig.16** Equivalent Stress (Von-Mise

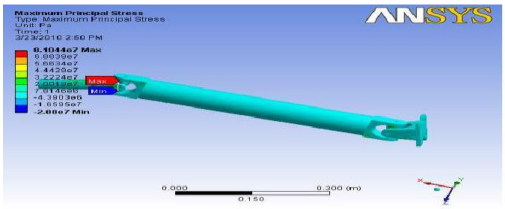


Fig.17 Maximum Principal Stress

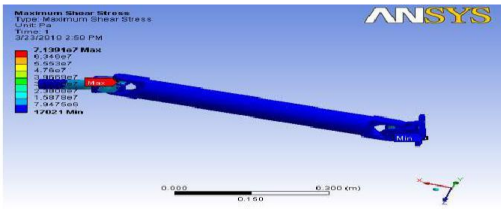


Fig.18 Maximum Shear Stress

VI. CONCLUSION

The modelling of Drive shaft assembly is performed by using CATIA and analysis is done using ANSYS (FEA). By conducting analysis on three different composite materials We got the results as E-CARBON has 12%reduction in Von-Mises stress and 79%reduction in weight than Structural Steel. Merely it has 24.5% increase in deformation than Structural Steel. E-GLASS has 2.5%reduction in Von-Mises stress and 74%reduction in weight than Structural Steel. Merely it has 20.6% increase in deformation than Structural Steel. E-GLASS POLYSTER has 19%reduction in Von-Mises stress and 72.4%reduction in weight than Structural Steel. Merely it has 64% increase in deformation than Structural Steel. By the obtained results it can be reasoned that the strains induced in all the materials are within their allowable limits. And it can likewise be noted that the materials which develop less bone-miss stress exhibit a little more distortion. Though E-Glass Polyester Resin induces 19% less stresses compared to structural steel, considering the changes in both deformation and stress and weight (which is least - 1600 kg/m3 among all the above materials), it can be concluded that E-CARBON can be utilized instead of conventional material like structural steel. And then that the weight and stresses induced in the drive shaft can be considerably lessened.

REFERENCES

[1]. A. Mahdi, A. R. Abutalib and R. Yonus, International Journal of Engineering and Technology, Vol. 3, No.2, 2006, pp. 227-237. Mack, J., Advanced polymer composites, Mater.Edge, 18, January 1988.

[2]. Schwartz, M.M., Composite Materials Hand Book, McGraw-Hill, New York, 1984.

[3]. Ashby, M.F., On Engineering Properties of Materials, Acta Metall., 37, 1273, 1989.

[4]. Jones, R.M., 1990,*Mechanics of Composite Materials*, 2e, McGraw-Hill Book Company, New York.

[5]. Aurtar K.Kaw, 1997,*Mechanics of Composite Materials*, CRC Press,New York..

[6]. Belingardi.G, Calderale.P.M. and Rosetto.M., 1990, "Design Of Composite Material Drive Shafts For Vehicular Applications",*Int.J.ofVehicle Design*, Vol.11,No.6,pp. 553-563.

[7]. John W. Weeton et. al. 1986,"*Engineers guide to composite materials, American Society for Metal*, New York.

[8]. Gill cooks composite resins for the 90s, M.C.Gill Doorway, 7, 27, spring 1990.

[9]. Partridge, I.K., Advanced Composites, Elsevier Applied science, New York, 1989.

[10]. Stephen R. Swanson, 1997, *Introduction to Design and Analysis with Advanced Composite*

Materials, Prentice-Hall International, Inc.

[11]. Dr.Kirpal Singh, Automobile Engineering, Vol. 1, 11th edition, 2008, Standard Publications Distributors, India.

[12]. Automobile Engineering' of TATA Mc GRAW HILL by K.K.JAIN & R.B.ASTAHANA.

[13]. JN Reddy, An Introduction to Finite Element Method, 8th edition, 2007, Me Graw Hill, India.

[14]. CATIA Manual, Engineers Cadd Centre Pvt.Ltd.,

[15]. Brown, J.R., et al., *Fire-Retardant Performance of Some Surface Coatings for Naval Ship Interior Applications*. Fire and Materials, 1995. 19(3): p. 109-118.

[16]. Ohlemiller, T., T. Cleary, and J. Shields, *Effect of Ignition Conditions on Upward Flame Spread on a Composite Material in a Corner Configuration*, in *41st International SAMPE Symposium and Exhibition*. 1996, SAMPE, Covina, CA, United States: Anaheim, CA, USA. p. 734-747.

[17]. Henderson, J.B., et al., *Characterization of the High-Temperature Behaviour of a Glass-Filled Polymer Composite*. Composites, 1987. 18(3): p. 205-215.

[18]. Henderson, J.B. and M.R. Tant, *Measurement of Thermal and Kinetic Propertiesof a Glass-filled Polymer Composite to High Temperatures*, in *9th EuropeanConference on Thermophysical Properties*. 1986: Manchester, UK. p. 17-28.

[19]. En.wikipedia.org. (2014). *Ansys*. [online] Available at: https://en.wikipedia.org/wiki/Ansys [Accessed 13 Oct. 2014].

[20]. En.wikipedia.org. (2014). *CATIA*. [online] Available at: http://en.wikipedia.org/wiki/CATIA [Accessed 14 Aug. 2014].

[21]. En.wikipedia.org. (2014). *Composite material*. [online] Available at: http://en.wikipedia.org/wiki/Composite_material [Accessed 9 Nov. 2014].