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Modeling and Analysis of Drive Shaft Assembly Using FEA

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Abstract:- The weight reduction of the drive shaft can have a certain role in the general weight reduction of the vehicle and is a highly desirable goal. Substituting composite structures for conventional metallic structures has many advantages because of higher specific stiffness and strength of composite materials. The advanced composite materials such as graphite, carbon, Kevlar and Glass with suitable resins are widely used 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 components construction in order to obtain the reduction of the weight without decrease 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 effective measures to obtain this result. Actually, there is almost a direct proportionality between the weight of a vehicle and its fuel consumption, particularly in city driving. This project is analysis done on drive shaft with different composite materials and concludes that the use of composite materials for drive shaft would induce less amount of stress which additionally reduces the weight of the vehicle. CATIA is the modeling 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 components construction in order to obtain the reduction of the weight without decrease in vehicle quality and reliability. The advanced composite materials such as Graphite, Carbon, Kevlar and Glass with suitable resins are widely used because of their high specific strength (strength/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 carry as well as the rotational speed at which they operate. The drive shafts are used in automotive, aircraft and aerospace applications. The automotive industry is exploiting composite material technology for structural components construction in order to obtain the reduction of the weight without decrease 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 effective measures to obtain this result. Actually, there is almost a direct proportionality between the weight of a vehicle and its fuel consumption, particularly in city driving.

II. ASSEMBLY OF DRIVE SHAFT ASSEMBLY USING CATIA

The sequence how the propeller shaft arrangement is assembled is discussed below.

- CATIA V5 is opened and a new assembly file is created by navigation 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 position is fixed using constrains position toolbar.
- Similarly all other components are added one by one and assembled using the coincidence, offset and parallelism constrains in constrains position toolbar.
- This completes the assembly of propeller shaft arrangement of Toyota qualis and is shown in the figure.

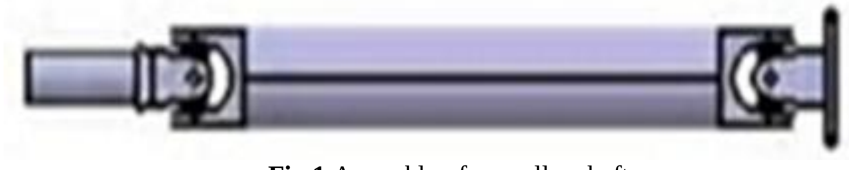
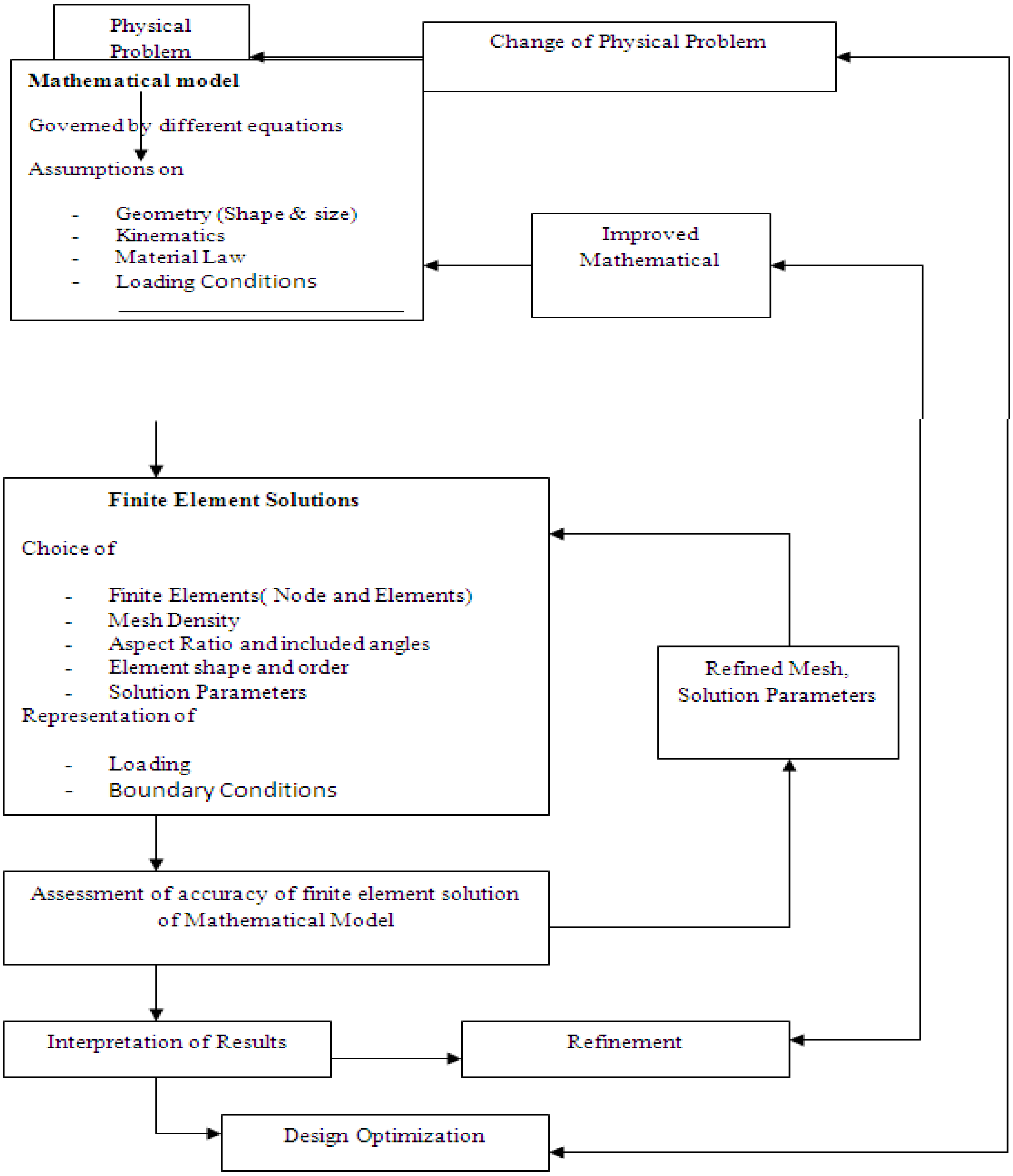


Fig.1 Assembly of propeller shaft

III. THE PROCESS OF F.E.A



IV. ANALYSIS OF DRIVE SHAFT ASSEMBLY UNSING ANSYS

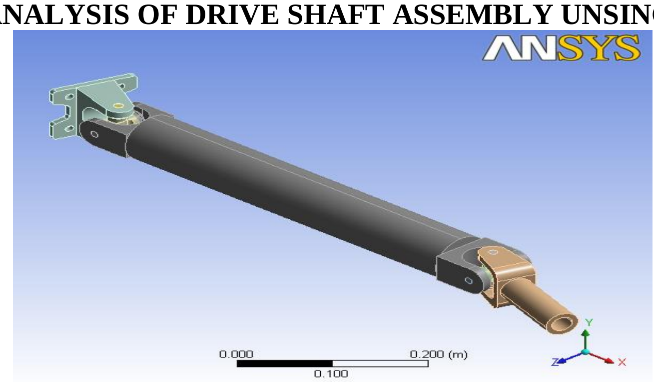


Fig.2 Imported Model Of Drive Shaft

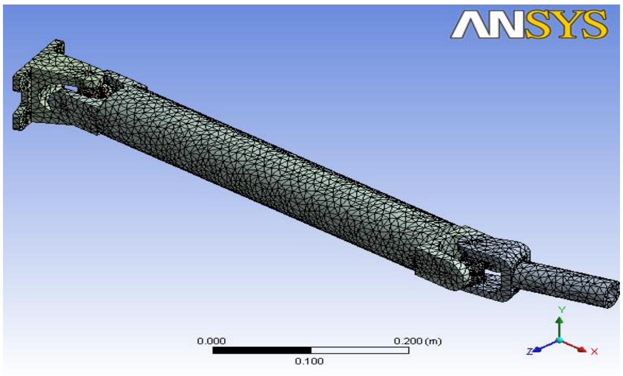


Fig.3 Meshing Of Assembly

V. RESULTS AND DISCUSSION

1. **STEEL:**

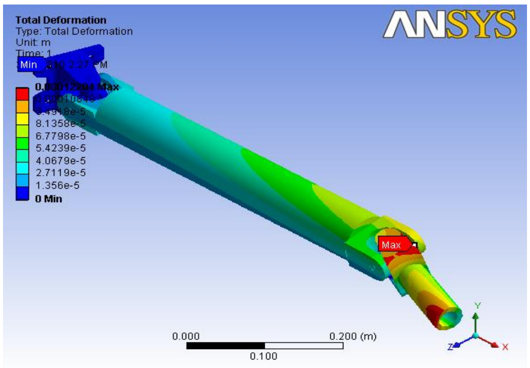


Fig.4 Total Deformation

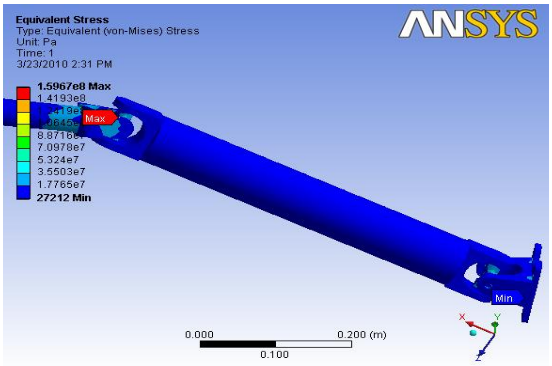


Fig.5 Equivalent Stress (Von-Mises)

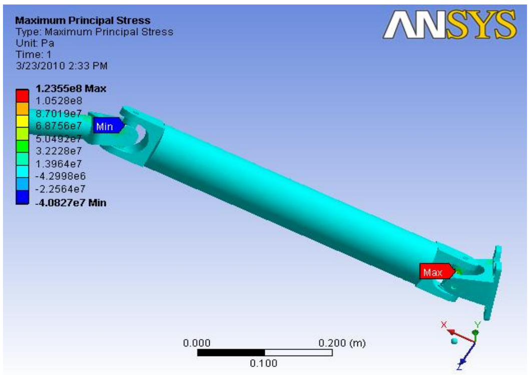


Fig.6 Maximum Principal Stress

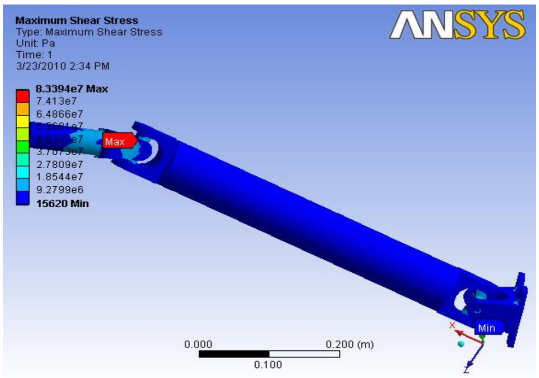


Fig.7 Maximum Shear Stress

2. **E GLASS:**

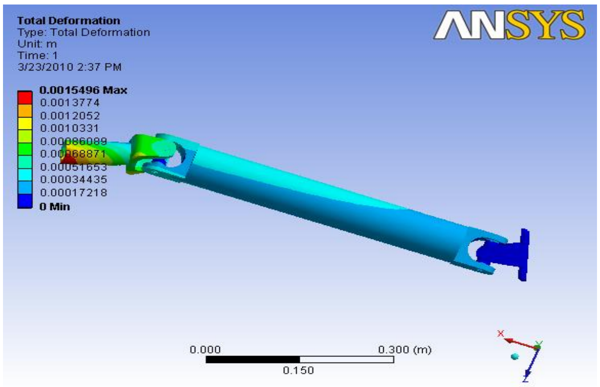


Fig.8 Total Deformation

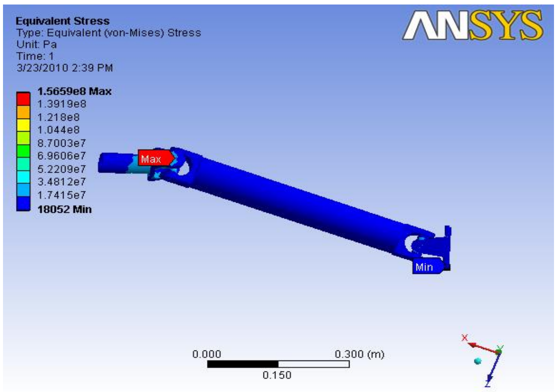


Fig.9 Equivalent Stress (Von-Mises)

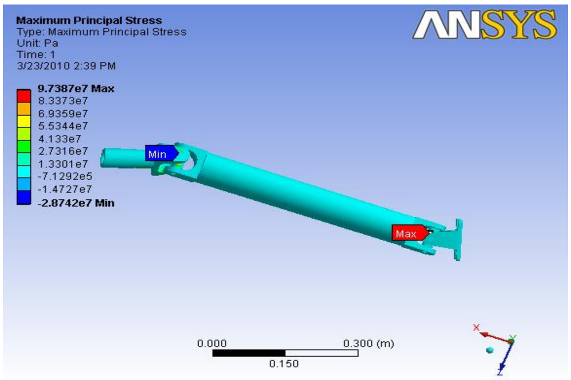


Fig.10 Maximum Principal Stress

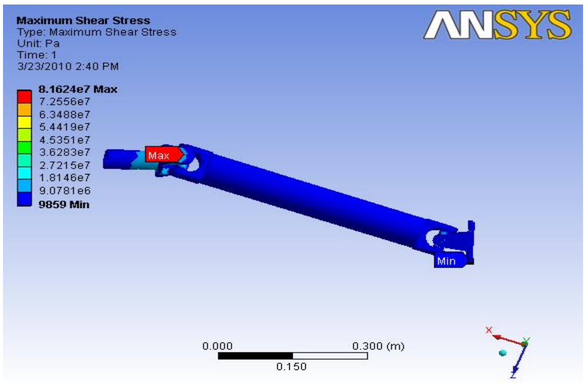


Fig.11 Maximum Shear Stress

3. E CARBON:

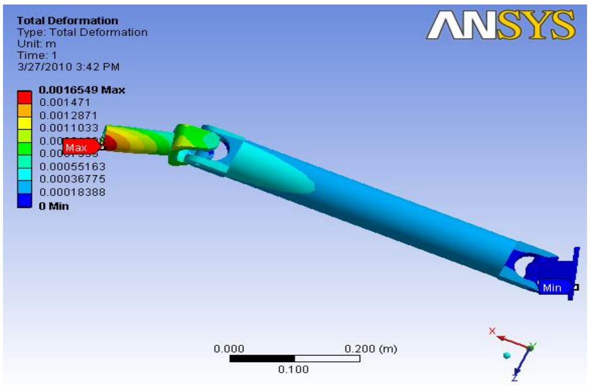


Fig.12 Total Deformation

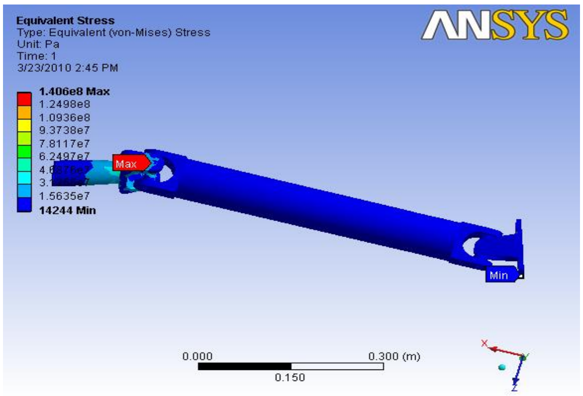


Fig.13 Equivalent Stress (Von-Mises)

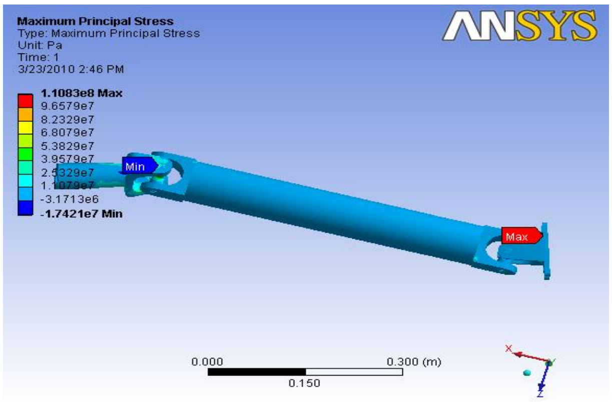


Fig.14 Maximum Principal Stress

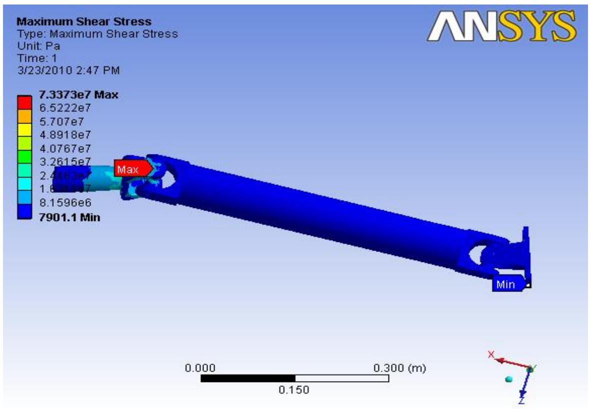


Fig.15 Maximum Shear Stress

4. E-GLASS POLYESTER:

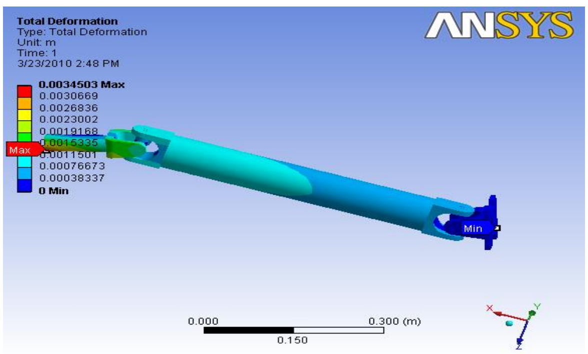


Fig.15 Total Deformation S)

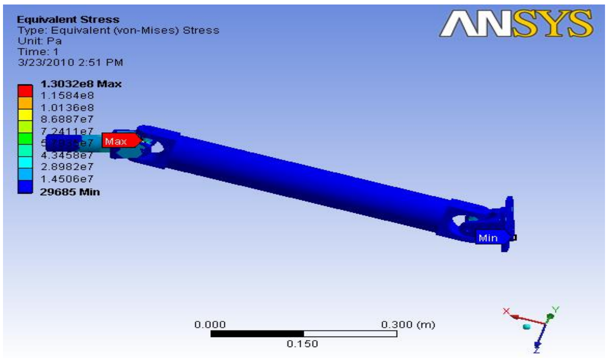


Fig.16 Equivalent Stress (Von-Mise

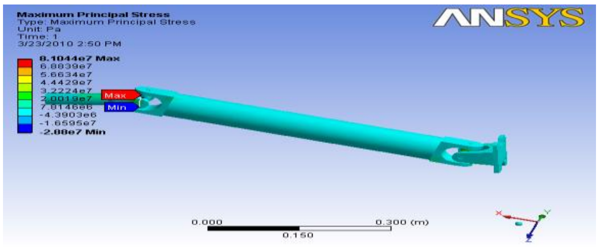


Fig.17 Maximum Principal Stress

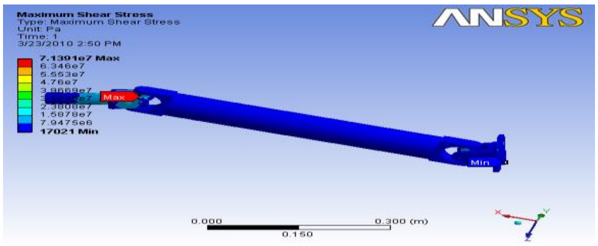


Fig.18 Maximum Shear Stress

VI. CONCLUSION

The modeling of Drive shaft assembly is done 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. But it has 24.5% increases in deformation than Structural Steel.E-GLASS has 2.5%reduction in Von-Mises stress and 74%reduction in weight than Structural Steel. But 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. But it has 64% increases in deformation than Structural Steel. By the obtained results it can be conclude that the stresses induced in all the materials are within their allowable limits. And it can also be observed that the materials which develop less von-mises stress exhibit a little more deformation. 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/m^3 among all the above materials), it can be concluded that E-CARBON can be used instead of conventional material like structural steel. So that the weight and stresses induced in the drive shaft can be considerably decreased.

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