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ANALYSIS AND WEIGHT OPTIMIZATION OF SHAFT BY USING ALUMINUM AND GLASS FIBER COMPOSITE MATERIAL

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ABSTRACT :- Continuous pressure put on scientists everywhere on the world these days to plan materials of improved properties create opportunities to study new methods of production in conjunction with entirely new and innovative materials such as alloys or composites. In this current research we study on composite shaft made up with glass fiber and aluminum composite with different combination of layer. In which apply different boundary condition in ANSYS analysis and take a result. On the basis of that result we final a best combination of glass fiber and aluminum composite. Also analysis of practical model on Torsion testing machine for mechanical properties.

Key Words: Composite, Glass Fiber, ANSYS, and CATIA.

I. INTRODUCTION

A drive shaft, or propeller shaft (prop shaft), or Carbon shaft is a mechanical component for transmitting torque and rotation, usually used to connect other components of a drive train that cannot be connected directly because of distance or the need to allow for relative movement between them. Drive shafts are carriers of torque. They are dependent upon twist and shear pressure, comparable to the distinction between the info force and the heap. They should along these lines be sufficiently able to bear the pressure, while keeping away from an excessive amount of extra weight as that would thusly build their latency. A car drive shaft is a turning shaft that sends power from the motor to the investigation and differential stuff of back tire drive (RWD) vehicles. Traditional steel drive shafts are generally made in two pieces to expand the key bowing common recurrence on the grounds that the bowing characteristic recurrence of a shaft is contrarily relative to the square of the range length. But the two-piece steel driveshaft involves three universal joints, an intermediary thrust bearing and a supporting bracket in its assemblage, which increases the total weight of the vehicle. Since one-piece composite drive shaft will suffice in the place of a two-piece steel driveshaft, it substantially reduces the inertial mass. Moreover, a composite driveshaft can be perfectly designed to effectively meet the strength and stiffness requirements. Since composite materials generally have a lower elasticity modulus, during torque peaks in the driveline, the drive shaft can act as a shock absorber. Moreover, the breakage of composite a drive shaft (particularly in SUV's) is less risky, since it results in splitting up of the fine fibers as compared to the scattering of broken steel parts in various directions.

1.1 PROBLEM STATEMENTS

The conventional drive shaft made up of steel is manufactured in two pieces in order to increase the fundamental natural frequency. Due to this, overall weight and cost of drive shaft increases.

In this work one piece composite drive shaft has been proposed to replace the two piece conventional steel shaft for power transmission in automobiles. For validation of this work, analytical and FEM simulation of conventional two-piece steel drive shaft and one-piece composite drive shaft has been proposed. Also the experimentation has planned for torsion testing and vibration testing of proposed one piece composite drive shaft.

1.2 OBJECTIVE

1. Finite element modelling & simulation of convectional steel drive shaft and proposed composite drive shaft using CATIA & ANSYS.
2. Final Best Combination of New Drive shaft.
3. Manufacturing of aluminium glass-epoxy composite drive shaft using final layer angle.
4. Experimental testing on rotating twisted testing machine to investigate angular deformation of drive shaft.
5. To validate ANSYS and practical results.
6. Make 3D model of new drive shaft as per final design and compared with original ANSYS result.

II. METHODOLOGY

1. By Using reverse engineering method study of original Drive shaft
2. As per specification of twisted testing machine make 3D model of Sample Shaft
3. 3D modeling of Sample shaft in CATIA & Convert to .stp file
4. Analysis of proposed shaft with different boundary condition in ANSYS
5. From ANSYS result final a best combination in GF + AL composite shaft
6. Manufacturing of proposed shaft as per required specification
7. Test shafts on twisted testing machine
8. Validation of ANSYS results with testing results
9. Apply new material to main shaft in ANSYS

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10. Comparing result of Proposal shaft and old shaft and conclude

III. FINITE ELEMENT ANALYSIS

MS SHAFT Model

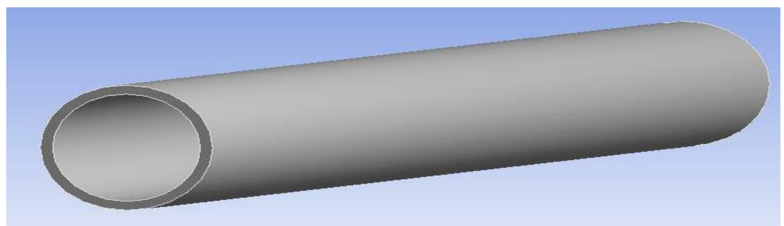

Fig.1 Geometry imported in ANSYS of MS

GF + AL SHAFT

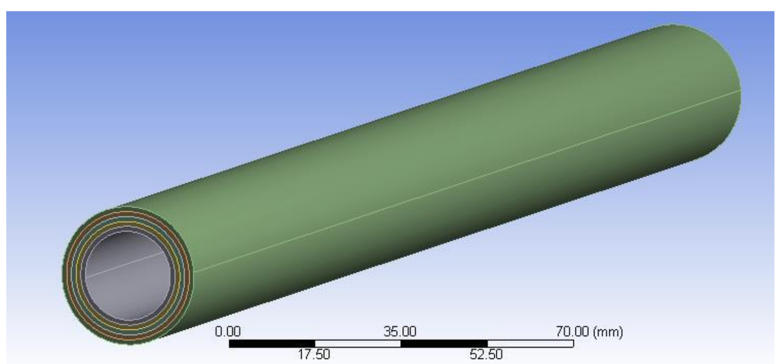

Fig.2 Geometry imported in ANSYS of GF& Al

MESHING

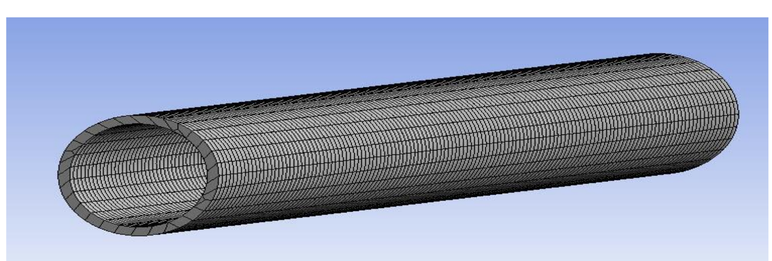

Fig.3 Meshing of M S Shaft

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Statistics	
Nodes	29131
Elements	4554
Mesh Metric	None

Fig.4 Meshing details of M S Shaft

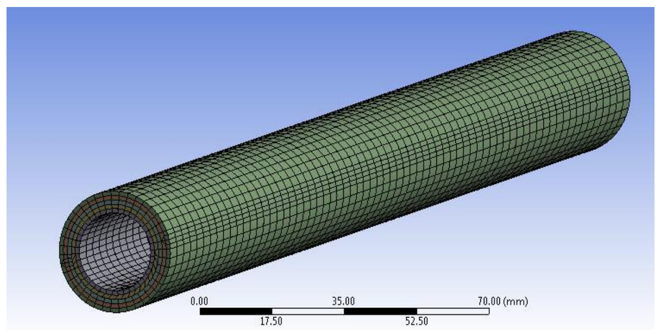

Fig.5 Meshing of GF & Al Shaft

Statistics	
Nodes	102481
Elements	14697
Mesh Metric	None

Fig.6 Meshing details of GF & Al Shaft

IV. ANSYS RESULTS

BOUNDARY CONDITION

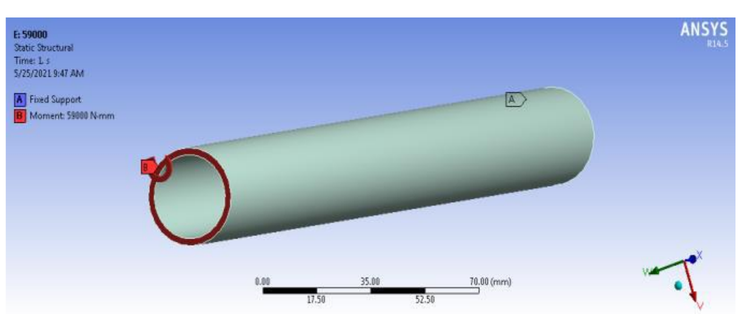

Fig.7 Show a boundary condition of applied 59000 N-mm Moment at one end of the shaft and other end is fix in MS Shaft

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STRESS

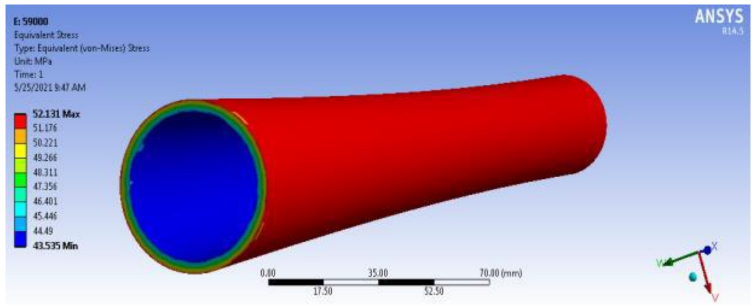

Fig.8 Show a stress in shaft after applied 59000 N-mm Moment at one end of the shaft and other end is fixed in MS Shaft

DEFORMATION

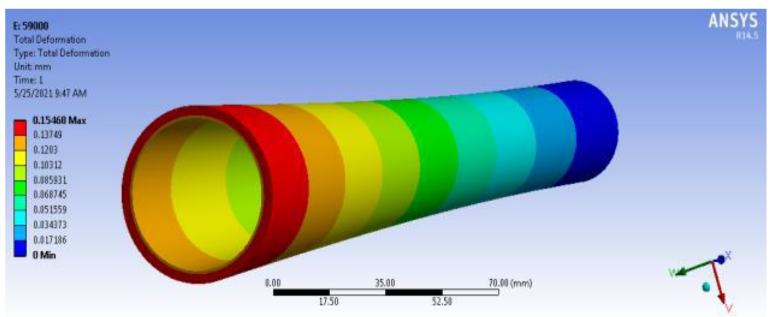

Fig.9 Show a Deformation in shaft after applied 59000 N-mm Moment at one end of the shaft and other end is fixed in MS Shaft

MATERIAL AL + GF

BOUNDARY CONDITION

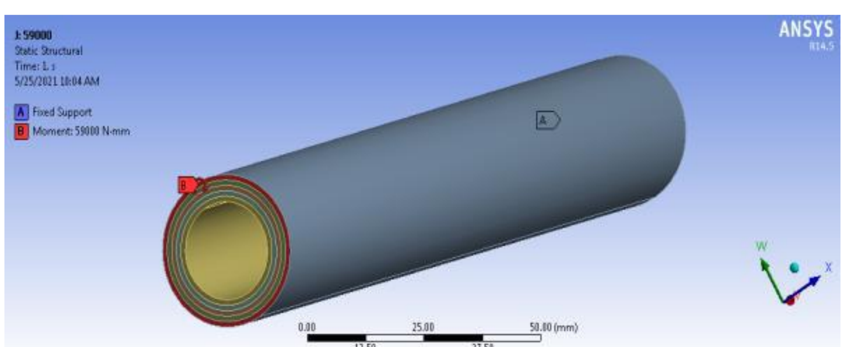

Fig.10 Show a boundary condition of applied 59000 N-mm Moment at one end of the shaft and other end is fixed in GF & Al Shaft

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STRESS

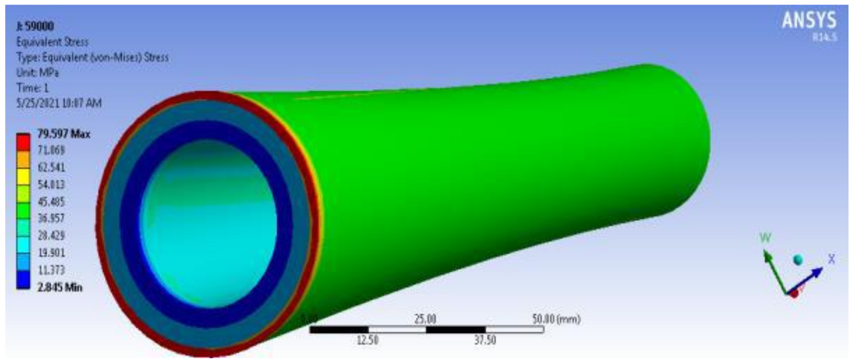

Fig.11 Show a stress in shaft after applied 59000 N-mm Moment at one end of the shaft and other end is fixed in GF & Al Shaft

DEFORMATION

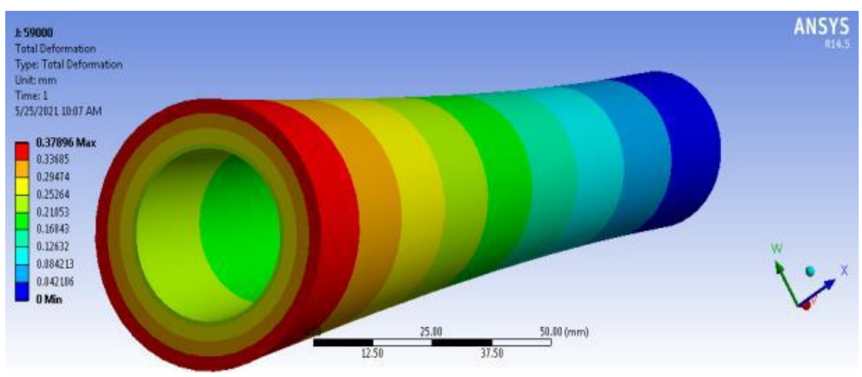

Fig.12 Show a Deformation in shaft after applied 59000 N-mm Moment at one end ofthe shaft and other end is fixed in GF & Al Shaft.

V. RESULT TABLE

Table 1. Results of applied moment for both shafts

Sr. No.	Load (N-mm)	MS		GF	
		Deformation (mm)	Stress (MPa)	Deformation (mm)	Stress (MPa)
1	10787	0.028	9.53	0.0041	27.01
2	21575	0.056	19.63	0.138	29.107
3	34323	0.089	30.32	0.22	46.302
4	49033	0.128	43.32	0.3149	66.15
5	59000	0.154	52.131	0.3789	79.59

VI. CONCLUSION

From the results obtained it is concluded that

1. Stress occurred in the composite drive shaft is less as compared to conventional drive shaft.
2. Composite Glass fiber & Aluminum shaft has less weight than conventional steel drive shaft taken for Analysis.

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