

MODELING AND ANALYSIS OF PROPELLER SHAFT WITH UNIVERSAL JOINTS

G.Sathasivam¹, C.Thamotharan², P.Naveenchandran³, C.Jagadeesh Vikram⁴

M.Tech¹, Student, Professor^{2,3}, Assistant Professor⁴,

Department of Automobile Engineering,
BIST, BIHER, Bharath University, Chennai, India.
thamodharan.auto@bharathuniv.ac.in

Abstract— A drive shaft, otherwise called a propeller shaft or cardan shaft, it is a mechanical part that transmits the torque created by a vehicle's motor into usable rationale compel to impel the vehicle. Presently a day's two piece steel shaft are for the most part utilized as a drive shaft. The two-piece steel drive shaft comprises of three all inclusive joints, a middle supporting bearing and a section, which expands the aggregate weight of a car vehicle and reductions fuel effectiveness, This work manages the substitution of routine two piece steel drive shafts with a one piece Eglass/epoxy composite drive shaft for a car application. The fundamental necessities considered here are torsional quality, torsional clasp and twisting common recurrence. The E-glass/epoxy as in which the steel has a part to transmit the required torque, while the E-Glass epoxy composite expands the twisting regular recurrence. An exploratory review was done to concentrate the static torsion capacity. Four cases were examined utilizing steel tube injured by various layers of composite materials. Comes about got from this review demonstrate that expanding the quantity of layers would improve the greatest static torsion around 66% for $\{+45/-45\}_3$ s covers higher than the immaculate aluminum and mass lessening of 42% contrasted and of steel drive shaft. A one-piece half and half composite full drive shaft is ideally broke down utilizing Finite Element Analysis Software and results were contr

Keywords — E-Glass Resin and Structural Steel for Stress Analysis, Strain Analysis and Deformation.

I. INTRODUCTION

A driveshaft is a turning shaft that transmits control from the motor to the differential rigging of a back wheel drive vehicles Driveshaft must work through continually changing edges between the transmission and pivot. Fantastic (Steel SM45) is a typical material for development[1-8]. Steel drive shafts are generally made in two pieces to build the key twisting characteristic recurrence in light of the fact that the bowing normal recurrence of a pole is conversely relative to the square of pillar length and corresponding to the square foundation of particular[10-16] modulus.

The two piece steel drive shaft comprises of three widespread joints, an inside supporting bearing and a section, which increment the aggregate weight of a vehicle. Control transmission can be enhanced through the diminishment of inertial mass and light weight[17-23].

Substituting composite structures for routine metallic structures has many favorable circumstances in view of higher particular firmness and higher particular quality of composite materials.

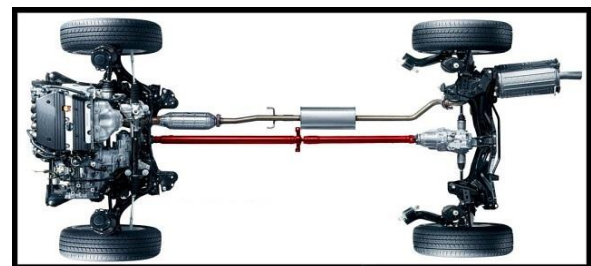


Fig.1. Schematic arrangement of under body of automobile

Composite materials can be custom fitted to effectively meet the plan necessities of quality[24-29], firmness and composite drive shafts weight not as much as steel or aluminum of comparative quality. It is conceivable to make one bit of composite. Drive shaft to dispense with the majority of the gathering associating two piece steel drive shaft[30-36].

II. FUNCTION OF PROPELLER SHAFT

To begin with, it must transmit torque from the transmission to the differential apparatus box. Amid the operation, it is important to transmit greatest low-outfit torque created by the motor. The drive shafts should

likewise be fit for pivoting at the quick speeds required by the vehicle.

The drive shaft should likewise work through continually changing points between the transmission, the differential and axles climb and down. This development changes the edge between the transmission and the differential.

The length of the drive shaft should likewise be equipped for changing while transmitting torque. Length changes are brought about by hub development because of torque response, street avoidance, braking burdens et cetera. A slip joint is utilized to make up for this movement.

III MATERIAL PROPERTIES

E- GLASS RESIN

A polymer is for the most part produced by step-development polymerization or expansion polymerization. At the point when consolidated with different operators to improve or in any capacity adjust the material properties of polymers the outcome is alluded to as a plastic. Composite plastics allude to those sorts of plastics that come about because of holding at least two homogeneous materials with various material properties to infer a last item with certain coveted material and mechanical properties.

Fiber-fortified plastics are a class of composite plastics that particularly utilize fiber materials to mechanically improve the quality and flexibility of plastics. The first plastic material without fiber support is known as a framework.

Low-E glass works by reflecting warmth back to its source. All items and individuals radiate shifting types of vitality, influencing the temperature of a space. Long wave radiation vitality, influencing the temperature of a space. Long wave radiation vitality is warmth, and short wave radiation vitality is obvious light from the sun. The covering used to make low-E glass attempts to transmit

short wave vitality[37-53], permitting light in, while reflecting long wave vitality to keep warm in the coveted area.

Low-E glass comes in high, direct and low pick up boards. In particularly cool atmospheres, warmth is held and reflected once again into a house to keep it warm. This is expert with high sun oriented pick up boards. In particularly hot atmospheres, low sunlight based pick up boards work to reject abundance warm by reflecting it back outside the space. Directed sun oriented pick up boards are additionally accessible for ranges with temperature vacillations.

Low-E glass is coated with a ultra-thin metallic covering. The assembling procedure applies this with either a hard coat or delicate coat handle. Delicate covered low-E glass is more sensitive and effortlessly harmed so it is utilized as a part of protected windows where it can be in the middle of two different bits of glass. Hard covered low-E glass is more strong and can be utilized as a part of single paned windows. It can likewise be utilized as a part of retrofit tasks.

The Mechanical properties of the E-Glass Resin material is tabulated in Table 1.

Table No.1 “Mechanical properties of the E-Glass Resin”

Description	E-Glass Resin
Density	2100 kg m ⁻³
Young's modulus (N/mm ²)	3.4E+10
Poisson ratio	0.366

STRUCTURAL STEEL

Strength

Having high quality, solidness, durability, and malleable properties, basic steel is a standout amongst the

most normally utilized materials in business and mechanical building development.

Constructability

Auxiliary steel can be produced into about any shape, which are either dented or welded together in development. Basic steel can be raised when the materials are conveyed nearby, though concrete must be cured no less than 1-2 weeks in the wake of pouring before development can keep, making steel a timetable benevolent development material.

Fire resistance

Steel is inalienably a non-flammable material. In any case, when warmed to temperatures found in a fire situation, the quality and solidness of the material is fundamentally decreased. The International Building Code requires steel be wrapped in adequate heat proof materials, expanding general cost of steel structure structures..

Corrosion

Steel is inalienably a non-flammable material. In any case, when warmed to temperatures found in a fire situation, the quality and solidness of the material is fundamentally decreased. The International Building Code requires steel be wrapped in adequate heat proof materials, expanding general cost of steel structure structures..

The properties of the Structural steel material is tabulated in Table 2.

Table No. 2: "Properties of the Structural steel"

Mechanical properties	Symbol	units	Value
Young's modulus	E	GPa	207.0
Shear modulus	G	GPa	80.0
Poisson's ratio	V	---	0.3
Density	ρ	Kg/m ³	7600
Yield strength	Sy	MPa	370

Shear strength	Ss	Mpa	--
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VI DESIGN TOOLS (SOLID WORKS)

Strong Works is Para strong based strong modeler, and uses a parametric element based way to deal with make models and congregations. Parameters allude to imperatives whose qualities decide the shape or geometry of the model or get together. Parameters can be either numeric parameters, for example, line lengths or circle measurements, or geometric parameters, for example, digression, parallel, concentric, level or vertical, and so on. Numeric parameters can be connected with each other using relations, which permit them to catch outline plan. Building a model in Solid Works more often than not begins with a 2D draw (Although 3D portrayals are accessible for power clients). The outline comprises of geometry, for example, focuses, lines, bends, conics (aside from the hyperbola), and splines. Measurements are added to the draw to characterize the size and area of the geometry. Relations are utilized to characterize properties, for example, intersection, parallelism, oppositeness and concentricity.

Fig.2 Model of propeller shaft with universal joints

V ANALYSIS TOOL (ANSYS WORKBENCH)

The ANSYS Workbench 14.5r stage is the structure whereupon the business' broadest and most profound suite of cutting edge building reenactment innovation is manufactured. An inventive venture schematic view entwines the whole recreation prepare, managing the client through even complex multi material science examinations with intuitive effortlessness. With bidirectional CAD network, capable exceptionally mechanized cross section, a venture level redesign instrument, inescapable parameter administration and incorporated improvement apparatuses, the ANSYS

Workbench stage conveys extraordinary profitability, empowering Simulation-Driven Product Development.

ANALYSIS OF PROPELLER SHAFT WITH UNIVERSAL COUPLING FOR STRUCTURAL STEEL

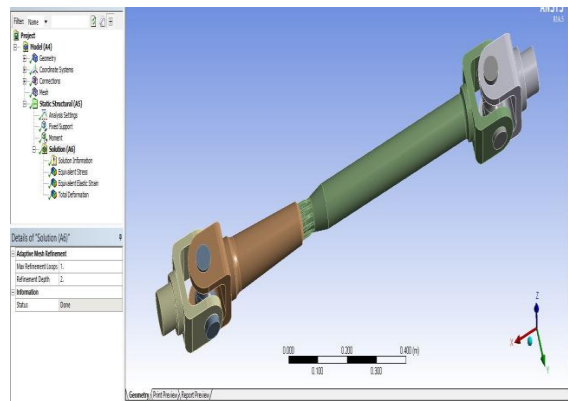


Fig.3 Geometry view of propeller shaft with universal coupling

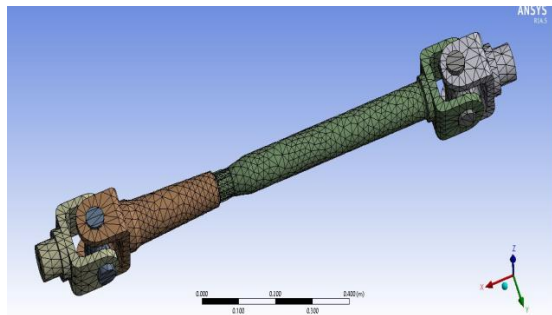


Fig. 4 Meshing view of propeller shaft with universal coupling

Fig.1. Air gap insulated piston Pro/E model

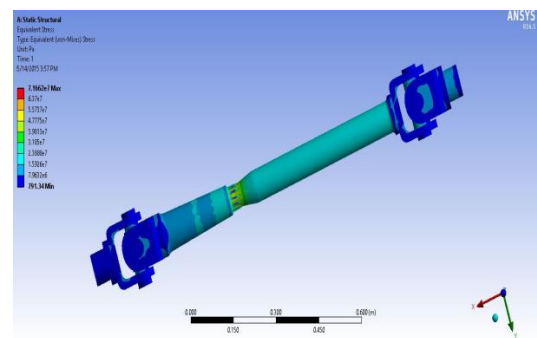


Fig.5 Stress Analysis

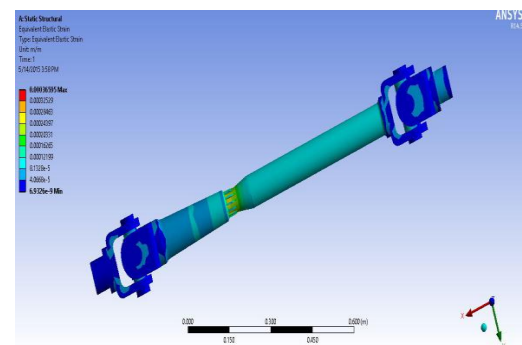


Fig. 6 Strain Analysis

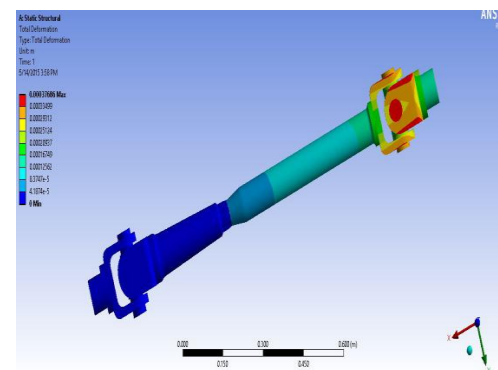


Fig. 7 Deformation

RESULT FOR STRUCTURAL STEEL

Descriptions	Steel
Max. Stress	5.7087e7
Min. Stress	1096
Max. Strain	0.00029716

Min. Strain	1.3661e-8
Deformation	0.00033251

ANALYSIS OF PROPELLER SHAFT WITH UNIVERSAL COUPLING FOR E-GLASS RESIN

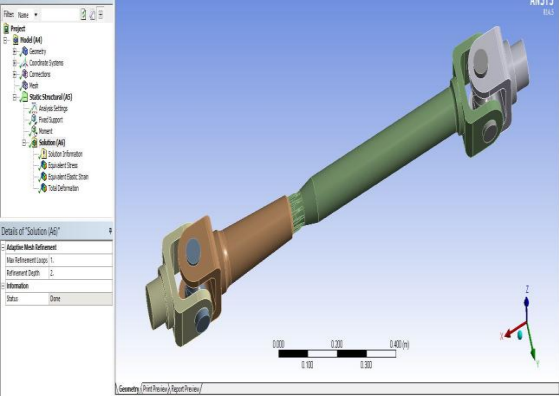


Fig.8 Geometry view of propeller shaft with universal coupling

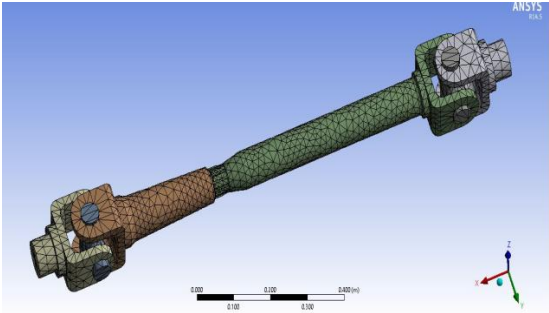


Fig. 9 Meshing view of propeller shaft with universal coupling

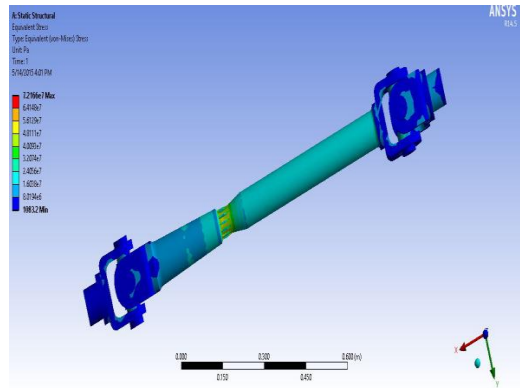


Fig. 10 Stress Analysis

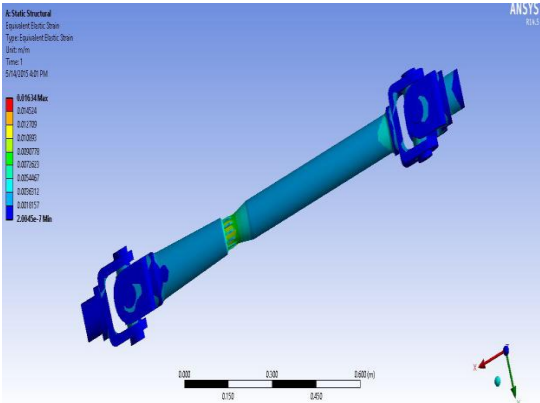


Fig. 11 Strain Analysis

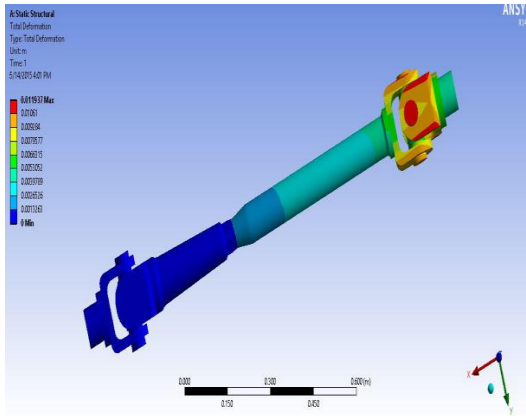


Fig. 12 Deformation

RESULT FOR E-GLASS RESIN

Description	E-Glass
Max. Stress	7.1684e7
Min. Stress	791.37
Max. Strain	0.0044705
Min. Strain	609379e-9
Deformation	0.00053946

ADVANTAGES

The power is not squandered in erosion (from the belt, chain, and so on., and particularly, gearboxes).Being a more straightforward gadget, an immediate drive component has less parts which could vibrate, and the

general clamor emanation of the framework is normally lower. Higher torque at low rpm. High torque and low inactivity permits speedier situating times on changeless magnet synchronous servo drives.

Mechanical backfire, hysteresis and versatility is evacuated dodging utilization of gearbox or ball screw instruments. e component has less parts which could vibrate, and the general commotion outflow of the framework is normally lower. Higher torque at low rpm. High torque and low latency permits quicker situating circumstances on perpetual magnet synchronous servo drives.

Mechanical kickback, hysteresis and versatility is expelled staying away from utilization of gearbox or ball screw systems.

APPLICATION

High speed

Medium or variable

Very low rotational speed.

CONCLUSION

The utilization of composite material has come about to immaterial measure of weight sparing in the scope of 28% when contrasted with basic steel shaft. Taking into contemplations the weight sparing, twisting, shear stretch incited and thunderous frequencies it is clear that E-Glass/Epoxy composite has the most reassuring properties to go about as swap for steel out of the considered two materials.

The introduced work was expected to diminish the fuel utilization of the car in the specific or any machine, which utilizes drive shafts, as a rule it is accomplished by utilizing light weight composites like E-Glass resin. The gave work additionally bargains plan advancement i.e. changing over two piece drive shaft (Structural steel shaft) into single piece light weighted composite drive shaft.

The drive shaft of the measurement, which were utilized then utilized for the material properties of composites were utilized the steadiness of drive shaft is guaranteed by constraining the incorporate values inside the allowable range in ANSYS workbench 14.5r. the outcomes are agreeable.

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