Analysis of a Composite Propeller Shaft for an Automobile Vehicle

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Abstract : The overall objective is to analyze a composite propeller shaft for power transmission applications. A propeller shaft for rear wheel drive automobile was optimally using E-Glass/Epoxy and High modulus (HM) Carbon/Epoxy composites. This work deals with the replacement of the two-piece steel propeller shaft with a single-piece E-Glass/Epoxy, high strength carbon-epoxy propeller shaft. Substituting the composite structure for the conventional metallic structures has many advantages because of higher specific stiffness and strength of the composite materials. The design parameters are made with the objective of minimizing the weight of the propeller shaft using the composite material and it shows significant potential in improvement of the performance of the propeller shaft. The analysis is done using ANSYS software.

Keyword **–R&D, Quality Function Deployment (QFD),Design, QFD Matrix., ignition ,insert.**

I. INTRODUCTION

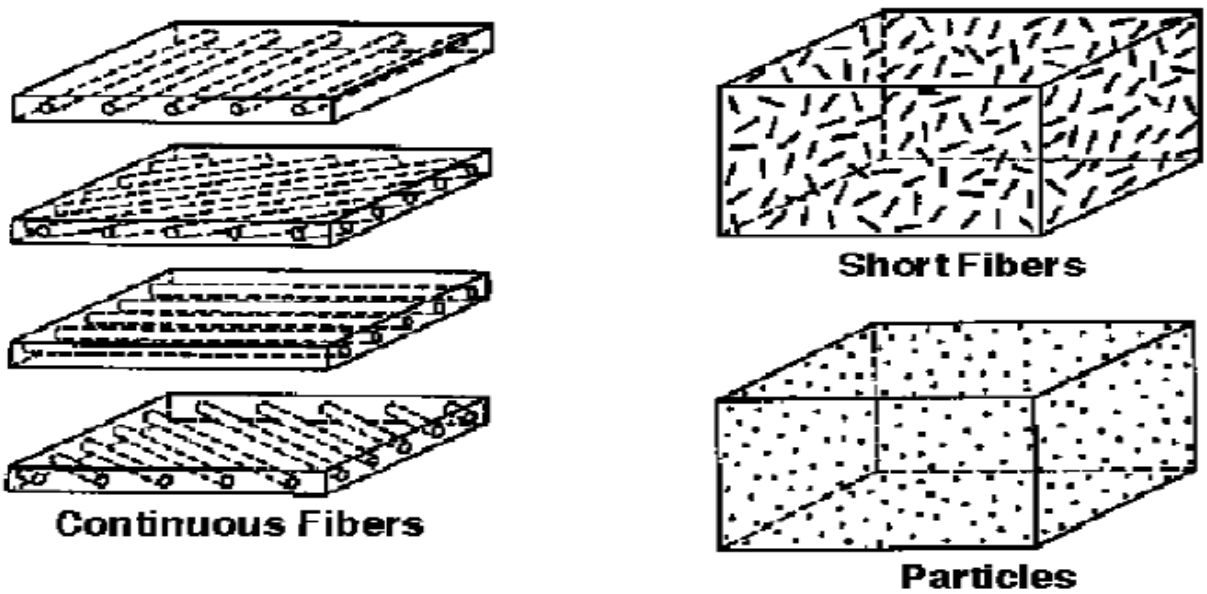
The most broadly utilized materials are composites due to many reasons such as adaptability to various different situation and easily combines with other materials to serve unique purpose and posses properties that are desirable according to relevant condition. Some materials such as glass, Kevlar, carbon, and graphite are advanced composite materials among proper resins since of their far above the ground specific force and towering specific unit.

Classification of Composites:

Composite materials can be categorized because

- Polymer milieu amalgamated
- Metal mold amalgamated
- Ceramic milieu

Figure 2.1 Types of Fibers



The types of fiber such as glass, graphite, carbon and Kevlar all these fiber can be taken in continuous or discontinuous length conditions. The material of the matrix can be ceramics, rubber, polymer, plastic and metal. Laminate is achieved by taking the no 5 fiber thin layer with matrix then consolidating them to required thickness condition. In order to make variety of range or mechanical or physical properties for composite lamina we can control the fiber orientation. In this figure continuous fiber, short fiber and particles are seen at the various orientation

Propeller shaft array in a Car Mode

predictable two-part of a set propeller shaft array in favor of rear wheel van lashing scheme is exposed in outline.

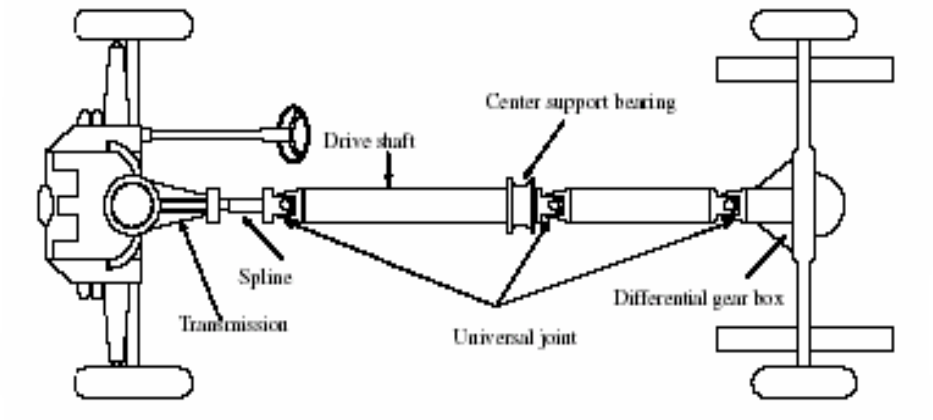


Figure 2.2 Arrangement of Propeller shaft

FINICKY SPECIFICATION OF THE PROBLEM:

The bending repeat of different sorts of cars, vans and road trucks their significant trademark repeat should not be higher. Beyond what many would consider possible isn't more than 6500 rpm. This is in light of the fact that to avoid the turning vibrations similarly as to as torque transmission limit should be increasingly noticeable to 2000 Nm. Unmistakable plan assurance are given in the Table 4.1. which shows the perfect organizing rule.

Mechanical Properties	Symbol	Units	Steel
Young's M	E	GPa	308.00
Shear Modulus	G	GPa	91.00
Poisson's Ratio	N	-----	1.4
D	Pi	Kg/m³	7600
Yield Strength	Sŷy	M-Pa	471
Shear Strength	Sš	MPa	----

Bending Vibration:

The pole is attempt transverse vibration. As it is essentially upheld bar it tends to be taken as stuck shaft. There is technique to establish out that the different twisting change and fundamental contemplations are as pursue.

$$f_{nt} = K_s \frac{30\pi p^2}{L^2}\sqrt{\frac{Er^2}{2\rho}} \quad ,$$

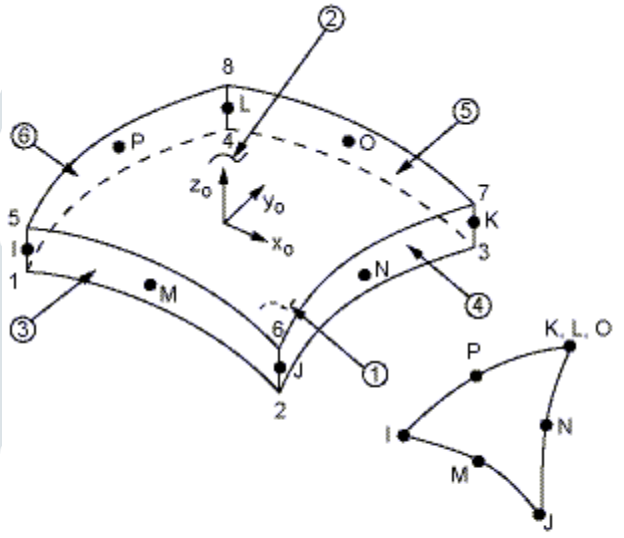
$$\frac{1}{K^2_s} = 1 + \frac{p^2\pi^2 r^2}{2L^2}\left[1 + \frac{f_s E}{G}\right], \qquad N_{crt} = 60 f_{nt} .$$

f_s = 2 for hollow circular cross-section

Modeling Linear Layered Shell:

SHELL99 associated SHELL281 each are used in bedded utilization of an auxiliary shell model as appeared in fig. the 2 parts allow up to 250 layers. The part has six degrees of chance at each hub: interpretations within the nodal x, y, and z bearings and pivots concerning the nodal x, y, and z-tomahawks.

SHELL281 is appropriate for examining slim to fairly thick shell structures. it's a 8-hub part with 6*degrees of chance at each hub: interpretations within the x, y, and z tomahawks, and revolutions concerning the x and the other y, and z-tomahawks. (When utilizing the layer various, the part contain travel point of chance because it were.)



x_o = Element x-axis if ESYS is not provided.

x = Element x-axis if ESYS is provided.

Figure : Shell 281 geometry

SHELL281 is appropriate for straight, enormous revolution, and additionally huge strain nonlinear applications. Change in shell thickness is represented in nonlinear investigations. The component represents devotee (load firmness) impacts of appropriated heaviness.
SHELL281 might be utilized for enclosed applications for displaying covered merged shells or development. The exactness in displaying compound shells is represented by the primary request shear misshapening hypothesis (for the most part alluded to as Mindlin-Reissner shell hypothesis).

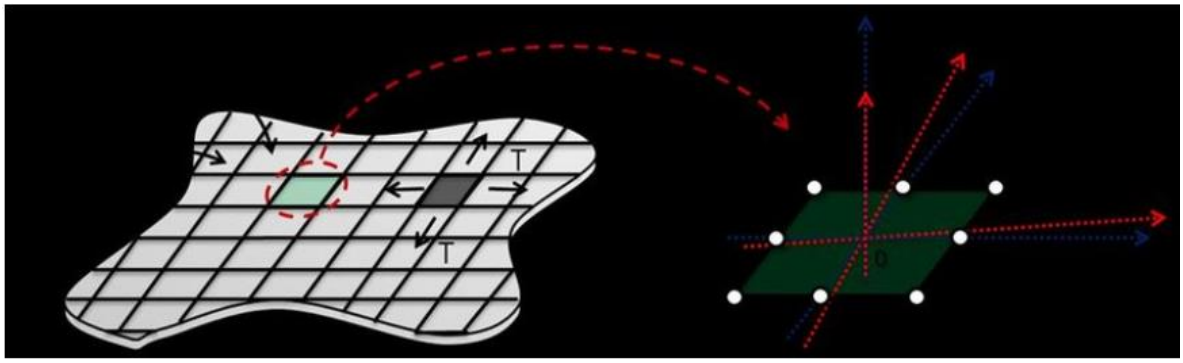


Illustration of the SHELL281 element.

the shell thickness and dynamically wide properties might be indicated utilizing segment orientation. SHELL281 might be associated with a shell part (SECTYPE). Shell area is a more wide procedure to portray shell improvement than the guaranteed constants choice. Shell zone headings consider layered composite shell definition, and give the data choices rather than demonstrating the thickness, material, course and number of coordination focuses through the thickness of the layers. Note that a solitary layer shell isn't blocked utilizing shell area definition, in any case gives powerfully adaptable choices, for example, the use of the ANSYS work specialist to depict thickness as a fragment of by and large headings and the measure of joining focuses utilized.

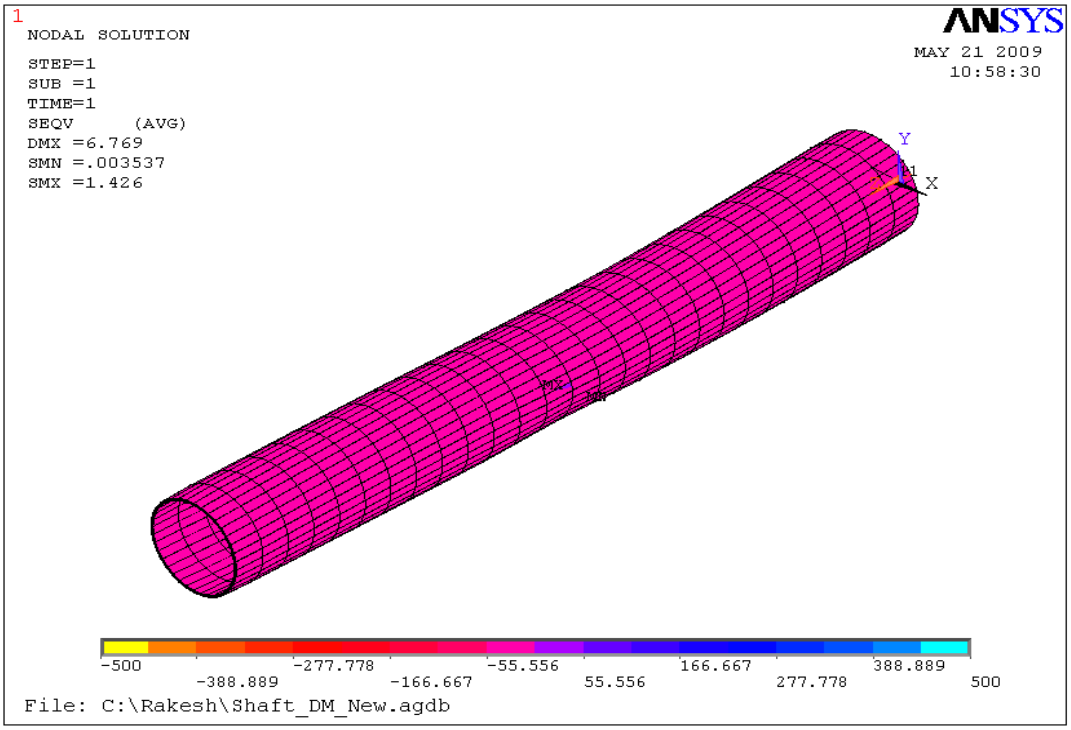
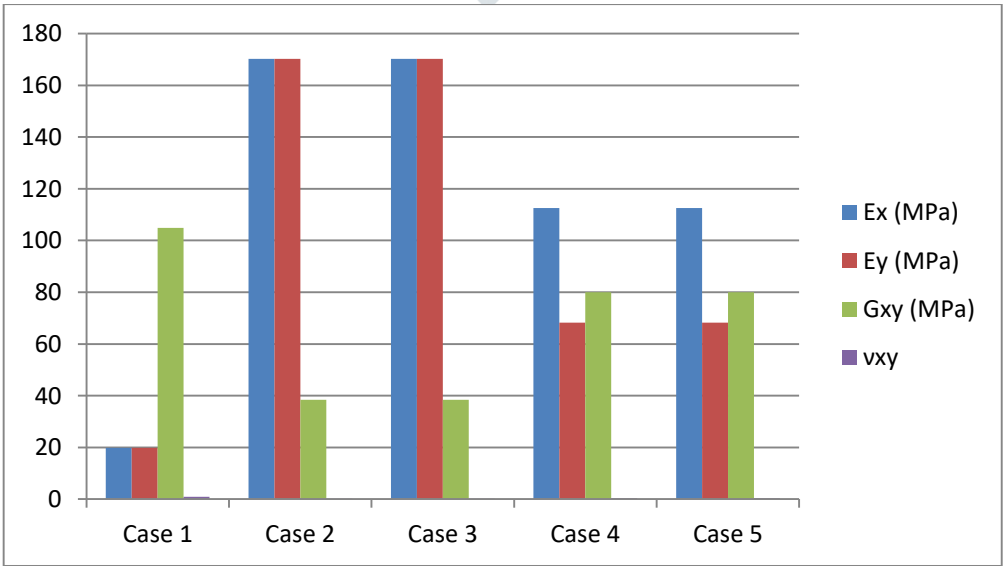


Figure :Von-mises Stresses along Fiber Direction of Case

CONCLUSION

The Carbon /Epoxy composite propeller shaft have been considered to reestablish the toughen propeller shaft of a methods for transportation.

A one-piece composite propeller shaft for back wheel drive vehicle has been planned ideally focal point of low of weight of the post which was introduced to the obliges, for example, torque securing cutoff focuses and standard bowing rehash.



The torsional buckling capacity of all carbon/epoxy composite propeller shafts in different stacking sequence is shown in graph above

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