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STATIC ANALYSIS OF SINGLE PIECE AND TWO PIECE PROPELLER SHAFT FOR AUTOMOTIVE APPLICATIONS

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ABSTRACT

Propeller shaft is used to connects gearbox to the final drive gears on vehicle through universal joint and used as drive shaft. A universal joint is the drive to be transmitted through a variable angle. The drive system is an arrangement for transmitting the driving thrust from the road wheels to the vehicle body. The drive is the transmission system between propeller shaft and differential. Differential mechanism is built up into the centre portion of the final drive. This permits the wheels to rotate at different speeds without interfering with the propulsion of the vehicle while taking a turn. The Torsional vibration is type of severe twisting motion in improperly designed coating machines. In recent years investigation of torsional vibration characteristics of the shaft systems transmitting torque, has become important part of the designer's responsibility. Satisfactory operation of heavy duty transmission system may depend to a large extent upon the successful handling of the vibration problem. Propeller shaft of most of the vehicles are found to show no. of modes of failures. Propeller shaft is rupture of tubes & excessive bending caused due to torsional shear stresses that get imposed during running time of propeller shaft.

KEYWORDS: Propeller Shaft, FEA, Static Analysis.

INTRODUCTION

The subject of vibration deals with the oscillatory motion of dynamic system. All bodies' possession mass & elasticity are capable of vibration. The mass is inherent of body & elasticity is due to relative motion of the parts of the body. The objective of the designer is to control vibration when it is objectionable & to enhance the vibration when it is useful, although vibrations in general are undesirable. Objectionable vibration in a machine main cause loosening of parts, its manufacturing & its eventual failure, the main causes of vibration are either unbalance forces in machines or external excitation. The demand for vehicle with lower fuels consumption & higher output leads to increasing rotation speeds in power train. This goes along with the tendency to reduce the mass of the power train. It increases the sensitivity of the vehicle for vibration & noise. Therefore dynamic analyses have become more & more important. Propeller shaft is no exception to this and hence need to be studied properly. Propeller shaft of various applications (especially automotive applications) is one of the important components of such systems. Different components of such systems have had contribution towards development of new emerging vehicles. The propeller shaft needs to be focused much because its development can contribute more towards proper development of technology for vehicles. Various types of propeller shafts have been dealt with, so that facts can be looked up more clearly. The propeller shaft driving shaft that connects transmission to the differential. It connects gear box the final drive gears of the vehicle through universal joint and serves as a drive shaft. The propeller shaft may be solid a tubular A solid shaft is stronger than a hollow or tubular shaft of the same diameter but hollow shaft is stronger than solid shaft of the same weight. Solid shafts are used inside a shaft housing that encloses the entire propeller shaft assembly. These are called torque tube drives.

LITRATURE REVIEW

There is a large body of literature on this subject, as evidence by reference at the end of this report. The object of this chapter is to present briefly, work done in various fields Related with this subject. The literature is presented separately for Propeller shaft different stresses corresponding to dangerous frequencies. There is a two type of propeller shaft is existing at the moment. They both there limitation and advantages .so here we check which one is doing the job best of them.

When the propeller shaft is running it have twisting moment which produces torsional shear stress at the time of working [1]. So both having different stress and different deflection [2].There is some bending stress is also occurred at the time of working but its magnitude is as low as compared with torsional stress [3].

There is also a possibility of breaking of propeller shaft when working. It happens when combination of magnitude of torsinal and bending stress is so high. But it doesn't happen at low speed .it happen only when vehicle is running at very high speed [4].

METHODOLOGY

1. Collection and/or calculation of necessary data.
2. Identification of various important dimensions of various elements.
3. Draw single and two piece propeller shaft on Pro-Engineering.
4. Analysis is doing on ANSYS.
5. Comparing the result of both Single and Two Piece Propeller Shaft.
6. After that Conclusion will be evaluated.

Boundary Condition:-

Boundary condition for analysis is Propeller shaft Hinged at one end and applying torque 410 NM at other end . and after that getting its deflection & stress's for both single & two piece propeller shafts.

Table 1: Propeller Shaft Parameters

Input Parameter	Output parameter
Torque (410Nm)	Stress's and deflection

As the Torque applies at one end there is Bending stress is generated inside a shaft . But its magnitude is low as compared with torsional stress.

RESULTS

The Practical Value Of Propeller Shaft Can Be Analyzed Using ANSYS Software.

Material properties:-

E=1.96×10^{11} N/M^2.

Density=7860Kg/m^3

Poisson's Ratio=0.3

Boundary condition: - hinged one end and applying Moment (410Nm) on other end

Single piece Propeller Shaft

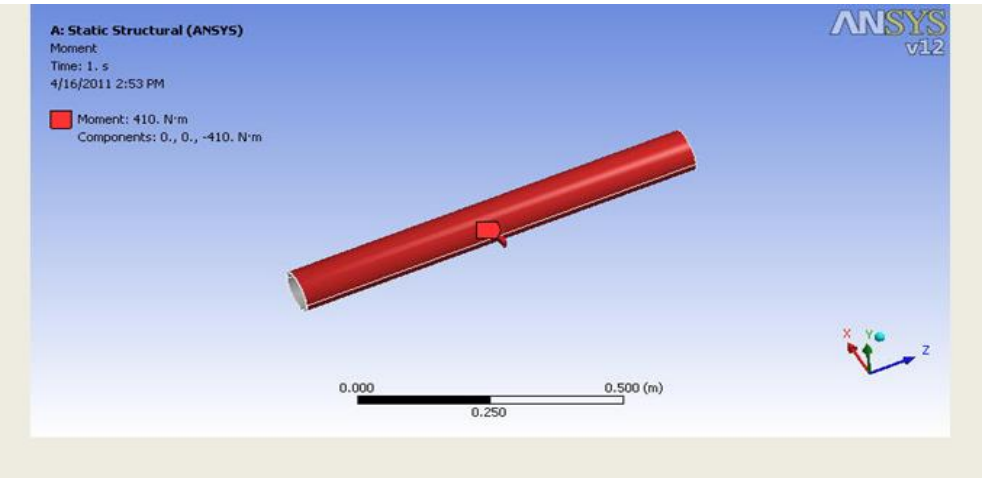

Fig1 Static Structural (moment)

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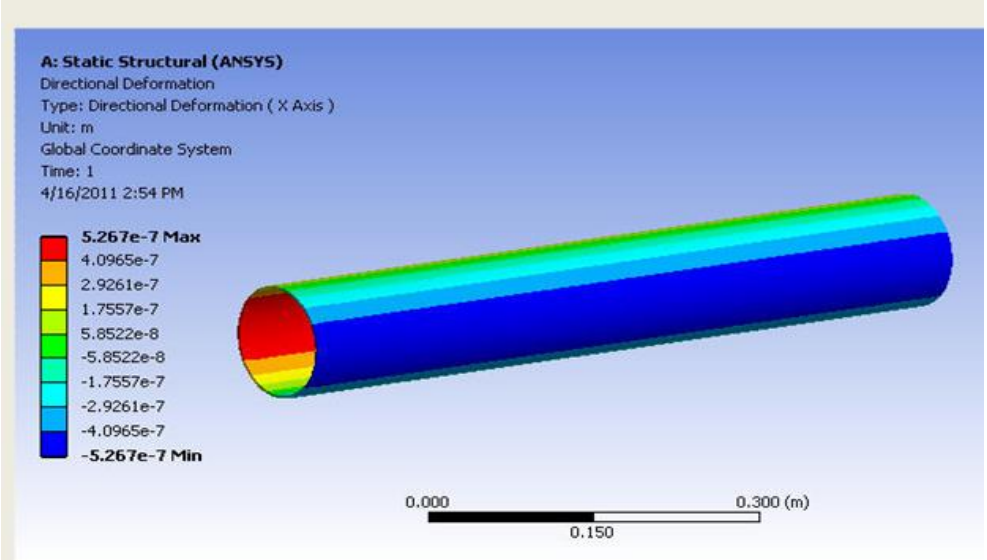

Fig 2 Static Structural (directional deformation)

Two Piece Propeller Shaft:-

$E=1.96\times10^{11}$ N/M^2.

Density=7860Kg/m^3

Poisson's Ratio=0.3

Boundary condition: - hinged one end and applying Moment (410Nm) on other end

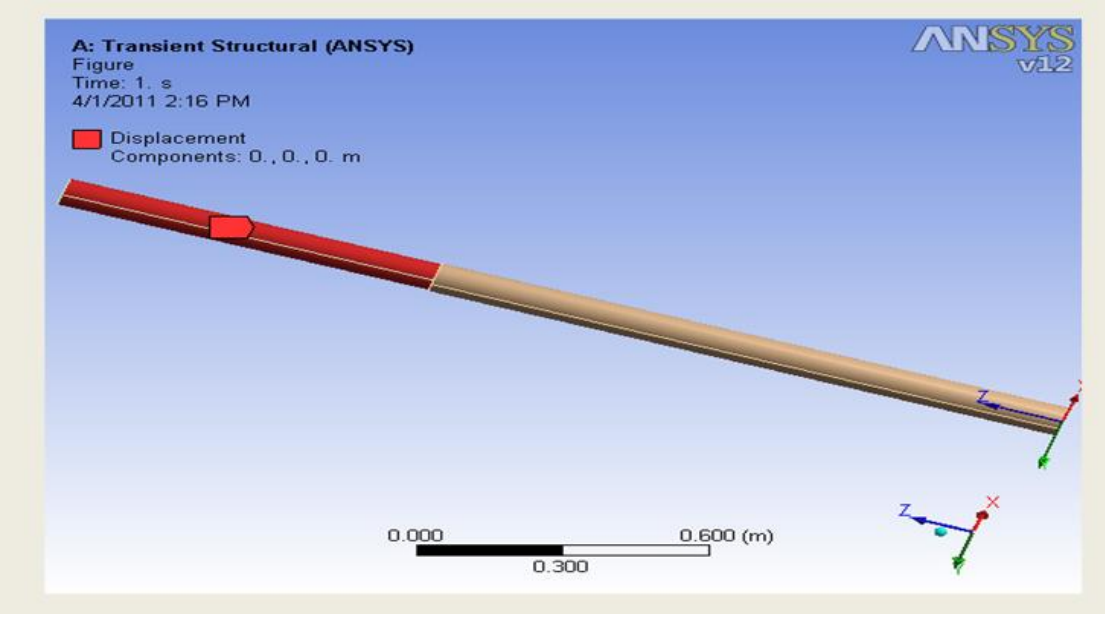

Fig 3 Static Structural (moment)

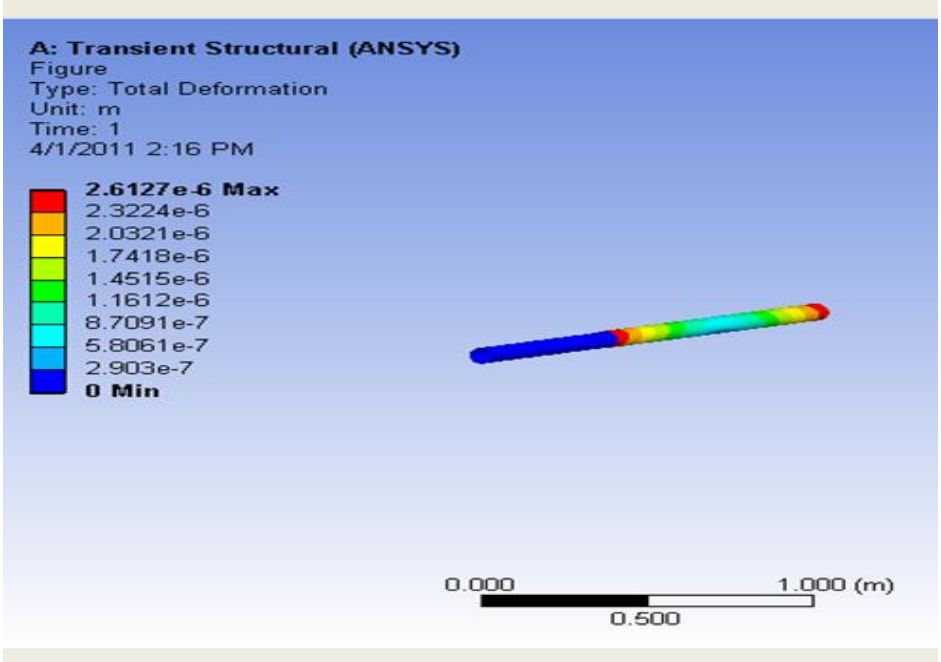

Fig 4 Static Structural
(directional deformation)

CONCLUSIONS

By above theoretical and analytical Analysis There can be replacement of two piece propeller shaft by one piece, only the parameter we need to modify is to Decrease the length of shaft and Increase diameter of shaft. As two piece propeller shaft now a days is an obsolete. So cost saving is also another approach for replacement of two piece propeller shaft. Because when natural frequency of system will decrease it increase the stress inside the propeller shaft. so for two piece propeller shaft there is a three natural frequency according to it stress should be varies so it decrease the life of shaft so this is another reason for better performance of single piece propeller shaft.

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