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DESIGN AND ANALYSIS OF DRIVE SHAFT USING DIFFERENT MATERIALS

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ABSTRACT

The objective of the drive shaft is to link with the transmission shaft with the help of universal joint. Shafts must be extremely tough and light to improve the overall act of the vehicle. Automobile industries are traveling materials which have high quality and reliability. A hollow tube is used for the main shaft. In actual, driveshaft is subjected to two types of loads i.e. torsional and vibrations. In this project,We can use Steel(AISI 1053),Titanium Alloy(ti-6al-7Nb) and Aluminum Alloy(al-6061). We can check the three different materials for the drive shaft. Also check the different types of loads, stress. Also check by two types of analysis, A static analysis is used to study the effects of steady loading condition on a structure. By getting best result we can choose that material for the Drive shaft.

Keywords- Ansys, Static analysis, Solidworks.

I.INTRODUCTION

1.1ROLE OF DRIVESHAFT

A driveshaft is a rotating shaft that transfers power from the engine to the differential gear in a rear wheel drive vehicles. Cylindrical shafts, with universal joints, are used on rear-wheel or four-wheel drive vehicles as shown in Fig.no.1.1. They send drive from the gearbox output to the final drive in the rear axle and drive then further continue through the final drive and differential. A hollow steel tube is used for the driveshaft. This is lightweight, but will still transfer considerable torque and resist bending moments. Driveshaft components= spider, propeller shaft, slip yoke, flange yoke, spider bearing are shown in Fig.The slip yoke is close to the engine end.

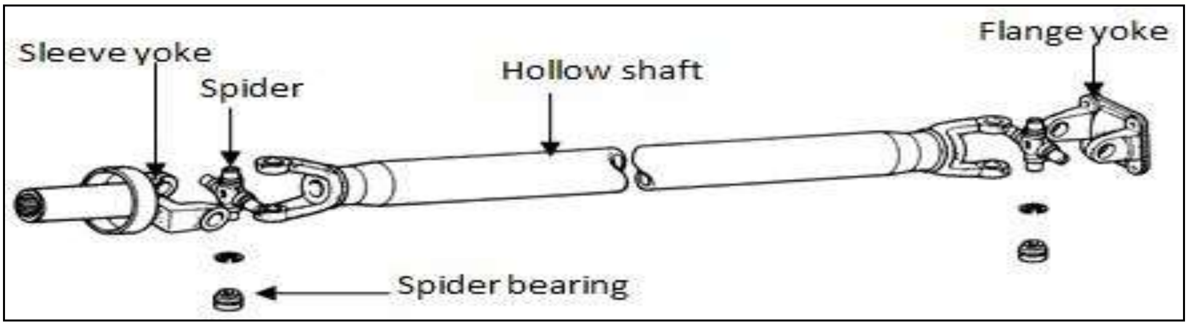

Fig. 1.1 Drive Shaft

1.2 Material use for the Driveshaft

1.2.1)Medium carbon steel(AISI 1053)

Medium Carbon Steel have carbon deliberations between 0.25% and 0.60%. These steels may be heat-treated by austenlizing, quenching, and then tempering to recover their mechanical properties. On a power-to-cost basis, the heat-treated medium carbon steels provide great load carrying capacity.

An iron-based combination is considered to be an *alloy steel* when manganese is countless than 1.65%, silicon over 0.5%, copper above 0.6%, or other lowest quantities of alloying essentials such as chromium, nickel, molybdenum, vanadium, or tungsten are present. A vast variety of distinct properties can be created for the steel by replacing these elements in the process to increase hardness, strength, or chemical resistance.

Uses-

Shafts and Gearing

Axle shafts, crankshafts and gearing plates are all made from medium-carbon steel. The ductility of the steel allows it to be molded into tinny shafts or toothed plates absent losing any of its tensile strength.

1.2.2)AluminiumAlloy(Al 6061 Alloy)-

6061 is a precipitation-hardened aluminium alloy field magnesium and silicon as its main alloying origins. First named "Alloy 61S", it was established in 1935. It has decent mechanical properties, exhibits good weldability and is very commonly extruded (second in popularity only to 6063). It is one of the most common alloys of aluminium for general-purpose use

Mechanical Properties-

The mechanical properties of 6061 be contingent greatly on the temper, or heat treatment, of the material Young's Modulus is 69 GPa (10,000 ksi) irrespective of temperature.

Annealed 6061 (6061-O temper) has maximum tensile strength no more than 310 MPa (45,000 psi), and maximum yield strength no more than 55 MPa (8,000 psi). The material has elongation (stretch before ultimate failure) of 25–30%

T4 temper 6061 has an ultimate tensile strength of at least 210 MPa (30,000 psi) and yield strength of at least 110 MPa (16,000 psi). It has elongation of 16%

Uses-

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6061 is commonly used for the following:

Construction of aircraft structures, such as wings and fuselages, more commonly in homebuilt aircraft than commercial or military aircraft. 2024 alloy is somewhat stronger, but 6061 is more easily worked and remains resistant to corrosion even when the surface is abraded, which is not the case for 2024, which is usually used with a thin Alclad coating for corrosion resistance.

Yacht construction, including small utility boats.

Automotive parts, such as the chassis of the Audi A8.

1.2.3)Titanium Alloy (Ti-6Al-7Nb)-

Ti-6Al-7Nb (UNS designation **R56700**) is an alpha-beta titanium alloy first synthesized in 1977. It featuring high strength and have similar properties as the cytotoxic vanadium containing alloy Ti-6Al-4V. Ti-6Al-7Nb is used as a material for hip protheses. Ti—6Al—7Nb is one of the titanium alloys that built of hexagonal α phase (stabilised with aluminium) and regular body-centred phase β (stabilised with niobium)

Uses-

Implant devices replacing such as : failed hard tissue, artificial hip joints, artificial knee joints, bone plates, screws for fracture fixation, cardiac valve prostheses, pacemakers, and artificial hearts.

Dental application

Aircraft materials

1.3) Properties-

1.3.1 Steel(AISI1053)

Density	7850kg/m^3	Tensile Yield Strength	250MPa
Young's Modulas	2E+05MPa	Compressive Yield Strength	250MPa
Poission's Ratio	0.3	Tensile Ultimate Strength	460MPa

1.3.2 Titanium-(ti-6al-7Nb)

Density	4500kg/m^3	Tensile Yield Strength	880MPa
Young's Modulas	116*E^3 MPa	Compressive Yield Strength	970MPa
Poission's Ratio	0.34	Tensile Ultimate Strength	950MPa

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1.3.3 Aluminium(6061)

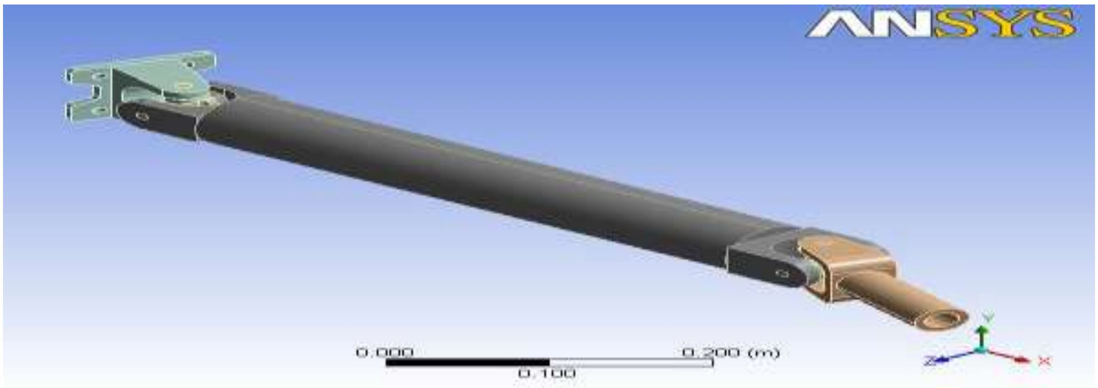
II.ASSEMBLY OF DRIVE SHAFT ASSEMBLY USING SOLIDWORKS

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

- SOLIDWORKS 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.

III.DRIVE SHAFT ASSEMBLY AND MESHING

3.1ANALYSIS OF DRIVE SHAFT ASSEMBLY USING ANSYS



Density	2680kg/m^3	Tensile Yield Strength	290MPa
Young's Modulas	68.3*E^3 MPa	Compressive Yield Strength	700MPa
Poission's Ratio	0.34	Tensile Ultimate Strength	310MPa

Fig. 3.1 : Drive Shaft Assembly

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3.2 Meshing Of Assembly

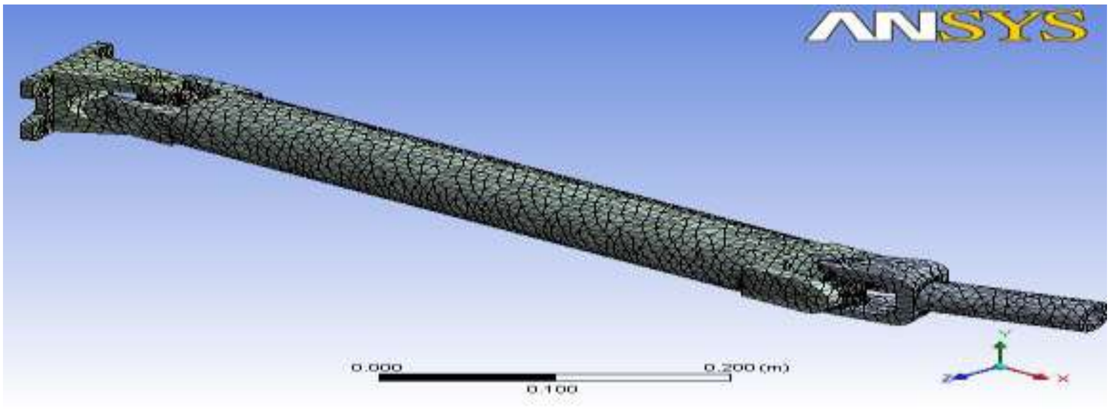

Fig. 3.2 Meshing Of Assembly

Assembly meshing reduces the overall meshing time, by combining the flow volume extraction and meshing operations. Assembly Meshing enables dramatically reduced time to mesh for typical CAD models by eliminating the tedious geometry clean-up

IV.RESULTS AND DISCUSSION

1) (A) Equivalent Stress-

Steel-maximum equivalent stress is **102.91MPa.**The Equivalent Stress of the Structural Steel of Diameter 100 – 50 is calculated and the values obtained are the Maximum Stress is 102.91MPa and the minimumEquivalent Stress 0.0026711.

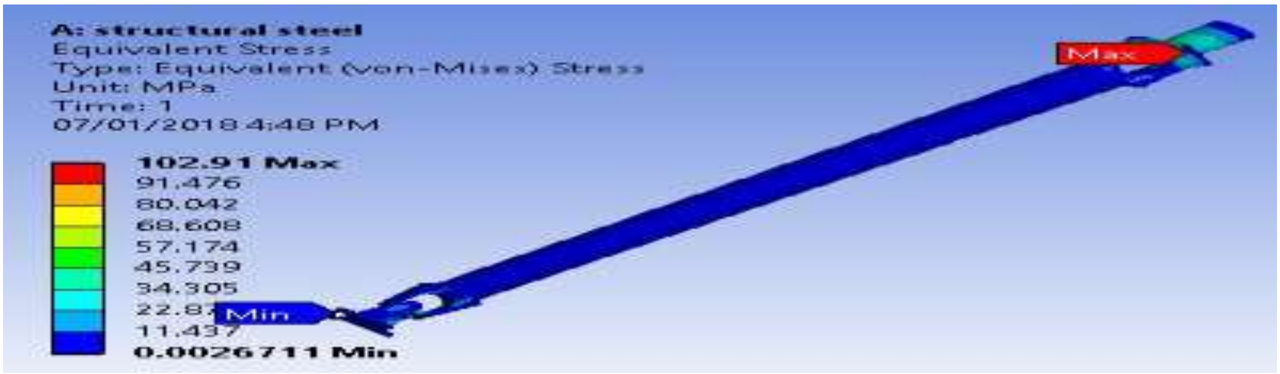

Fig. 4.1.1 Equivalent Stress for Steel

Titanium- maximum equivalent stress is **101.1MPa**. The Equivalent Stress of the Structural Steel of Diameter 100 – 50 is calculated and the values obtained are the Maximum Stress is 102.91MPa and the minimum Equivalent Stress0.0050109.

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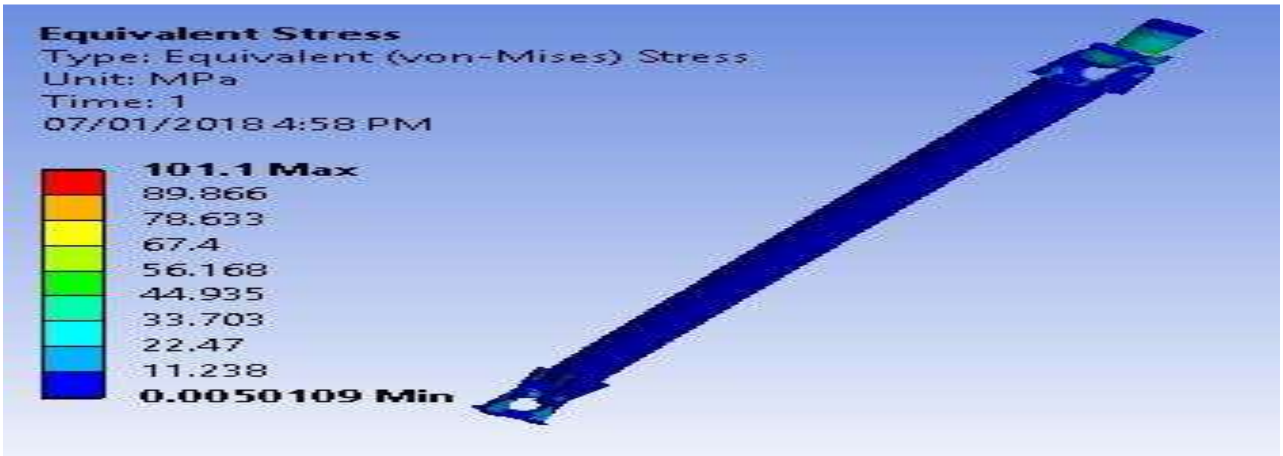

Fig. 4.1.2 Equivalent Stress for Titanium

Aluminium-maximum equivalent stress is 102.04MPa.**Aluminium-** maximum equivalent stress is **113.69MPa**. The Equivalent Stress of the Structural Steel of Diameter 100 – 50 is calculated and the values obtained are the Maximum Stress is 113.69MPa and the minimum Equivalent Stress -19.0999

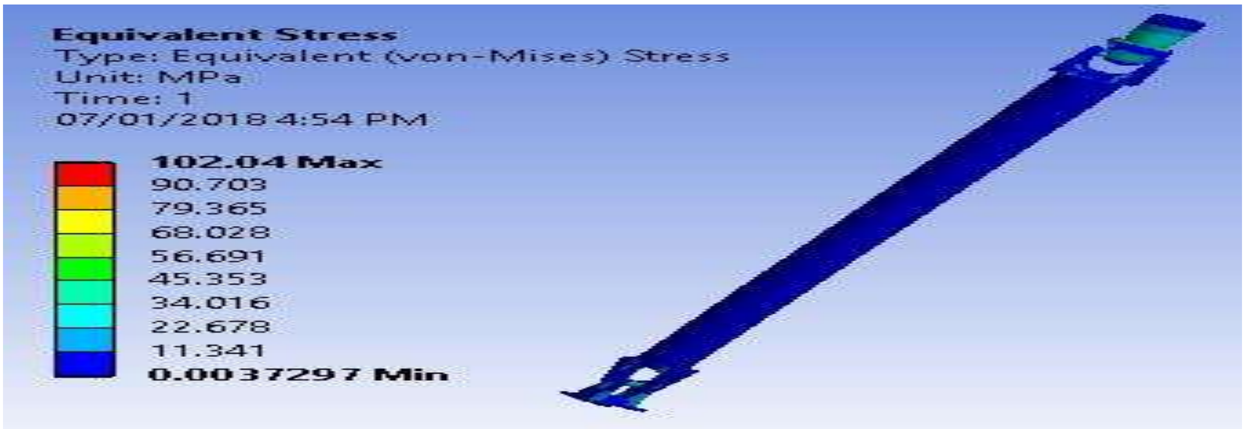

Fig. 4.1.3 Equivalent Stress for Aluminium

2)(B) Maximum Principal Stress:

Aluminium Alloy – maximum principle stress is 112.43MPa. **Steel**-maximum Principal stress is **112.43MPa.**The Principal Stress of the Structural Steel of Diameter 100 – 50 is calculated and the values obtained are the Maximum Stress is 112.43MPa and the minimum Equivalent Stress -17.77MPa.

Fig. 4.2.1 Maximum Principal Stress for aluminium

Structural steel-maximum principle stress is 111.38MPa. Structural Steel – maximum principle stress is 111.38MPa. **Steel**-maximum Principal stress is **111.38MPa.**The Principal Stress of the Structural Steel of Diameter 100 – 50 is calculated and the values obtained are the Maximum Stress is 111.38MPa and the minimum Equivalent Stress-16.59MPa**.**

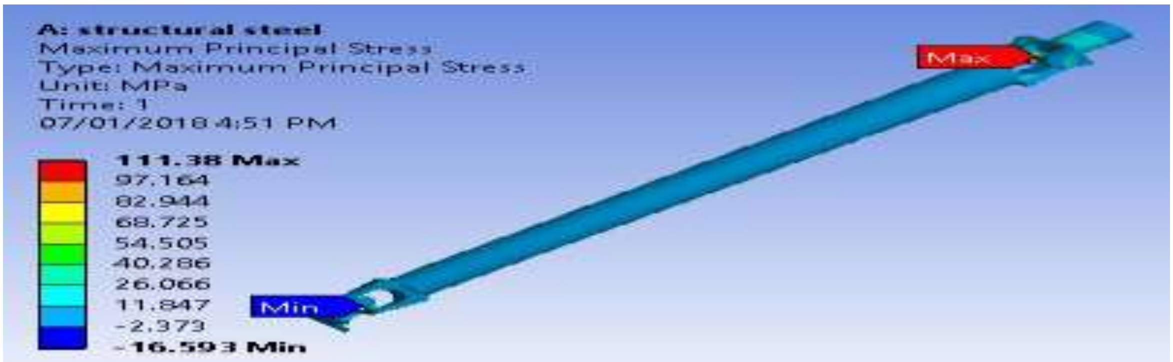

Fig. 4.2.2 Maximum Principal Stress for Structural steel

Titanium-maximum principle stress is 113.69MPa. Structural steel-maximum principle stress is 113.69MPa. Structural Steel – maximum principle stress is 113.38MPa. **Steel**-maximum Principal stress is **113.69MPa.**The Principal Stress of the Structural Steel of Diameter 100 – 50 is calculated and the values obtained are the Maximum Stress is 113.69MPa and the minimum Equivalent Stress -19.09MPa.

Fig. 4.2.3 Maximum Principal Stress for Titanium.

V.CONCLUSION

- The presented work was aimed to reduce the fuel consumption of the automobile in the particular or any machine, which employs drive shafts; in general it is achieved by using light weight material like Aluminium.
- But the Equivalent stress and maximum principal is minimum in Titanium.
- So we can preferred to used the Titanium material for designing of the drive shaft.But this is excluding the cost of the material.Whenincuding the cost of the material the titanium is not so preferable material then the other two material.

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