Design And Analysis Of Wheel Hub Of Baja ATV In Ansys.

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Abstract - .The wheel assembly consist of the knuckle ,wheel hub ,break disc, bearings and other integrated parts. For this components , we used materials like Aluminium Alloy 7075 and 6061 for the lightweight wheel assembly. BAJA SAE gives us this exact opportunity to build our ATV vehicle. We used various software's like SOLIDWORKS, ANSYS, CATIA V5, MATLAB and LOTUS SHARK. The cad model of the Wheel Hub is designing in SOLIDWORKS with the coordinates from the LOTUS SHARK and done FEA analysis and Fatigue analysis in ANSYS to understand the effects of forces on wheel Hub.

Key Words: Wheel hub, ANSYS

1.INTRODUCTION

The primary objective of BAJA SAEINDIA has always been to develop an understanding in the fresh and curious minds about entering the industrial reign. The purpose is to help the undergraduates enlarge their spectrum in technical and practical approaches, to trigger the prefrontal cortex and increase problem-solving and planning skills, enhance the managing capability, along with core technical knowledge.

  In this project we will design a wheel hub of ATV vehicle. Wheel hub is rotary part of wheel assembly where the break disc is mounted on one side and Wheel is mounted on other side. That's why the wheel hub is very important part in the wheel assembly under the safety conditions. Therefore the material selection is also important with respect to the safety and manufacturing point of view. There is lot of time varying forces apply on wheel hub which is created a fatigue in it. By doing fatigue analysis we can predict the life span and the forces it can sustain.

2. MATERIAL SELECTION

Wheel Hub is very important part in wheel assembly. There are many forces acting on the wheel hub which affect on the strength. The material which selected should have high strength, low weight, less price and easy manufacturing. Auminium 7075 have high weight to strength ratio, low weight easily machinable and corrosion resistant.

Table -1: Mechanical Properties of Al 7075

Properties	Values
Density	2810 kg/m^3
Hardness, Vickers	175 HV
Ultimate Tensile Strength	572 Mpa
Tensile Yield Strength	503 Mpa
Modulus of Elasticity	71.7 Gpa
Thermal Conductivity	160 W/mk
Poisson's Ratio	0.33

3. CAD MODEL OF WHEEL HUB

The CAD model of wheel hub done in SOLIDWORKS. The CAD model is designed by consider the coordinates from the lotus shark software and the inner diameter of wheel rim. Also considering the various forces acting on wheel hub. The CAD file is saved in STEP format or IGES format and then imported in Ansys software. Figure 1,2 and 3 shows the front, side and isometric view of wheel hub.
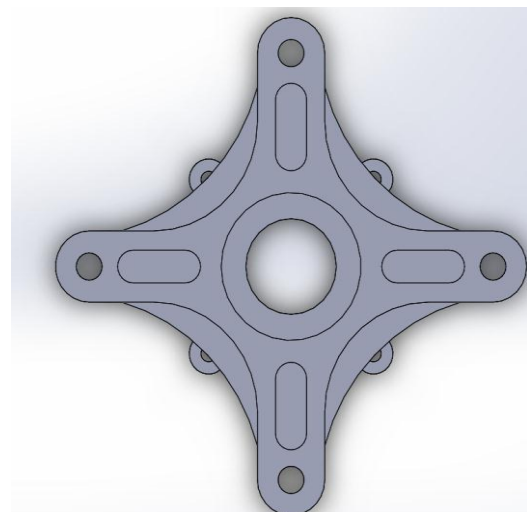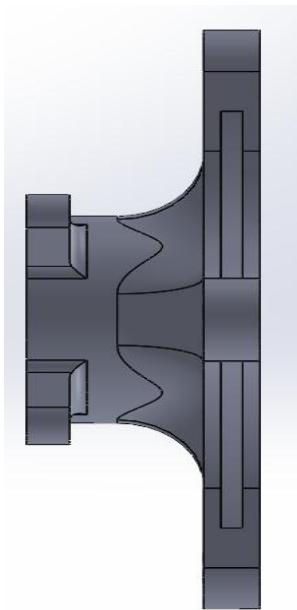

Fig 1: Front View
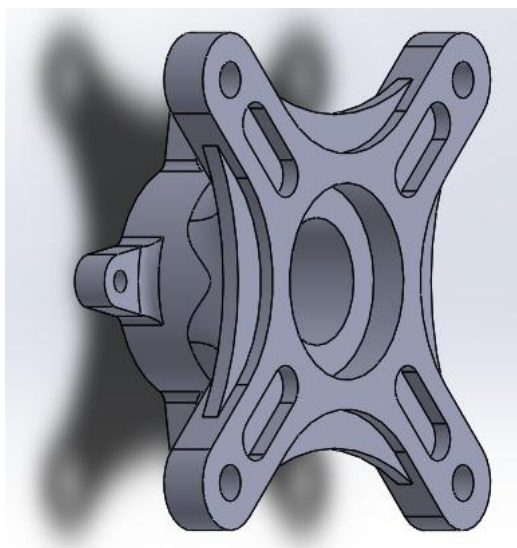
Fig 2: Side View

Fig 3: Isometric View

4. CALCULATION

Calculation of forces acting on wheel hub is calculated by real time dynamic situation in BAJA SAE. Forces acting on wheel hub are calculated as follows:

4.1 BUMP FORCE ON WHEEL HUB

When the bump come in the path of wheel, the vertical force(Fv) acts the contact patch of tyre and wheel. This Force is called as bump force. This force is greater than the static load(Fs). The static force acted due to self weight of the vehicle. This force is considered as the 3 times of gravitational acceleration.

The weight distribution of ATV vehicle from front to rear is 40:60.

$$Fs = m \times 0.6 / 2$$

This force is transmitted to hub centre and given by:

$$Fv = 3 \times g \times Fs$$

$$Fv = 2425.5 \ N$$

4.2 CORNERING FORCE

The condition when the vehicle takes turn, the weight of vehicle is shifted from inner wheels to outer wheels. Then there is cornering force (Fc) generated when the speed is V and the turning radius is R.

$$Fc = (m \times V^2) \div R$$

As m = 40% weight of front = 40% of 275Kg

R = Turning Radius = 1.4m

V = Speed of vehicle = 50kmph

Fc = 15,157 N

4.3 BRAKING Moment

The Braking Moment for the vehicle is 640 N-mm.

5. ANALYSIS

In this project we done the static structural analysis and Fatigue analysis. In the analysis of wheel hub, We determined the total deformation, Maximum shear stress , factor of safety and fatigue factor of safety and life of component.

5.1 MESHING

Meshing is done in ansys environment. Tetrahedral free meshing done on wheel hub having element size of 3mm. Also give refinement to the fillet where the wheel is mounted. Fig 4 shows the meshing.
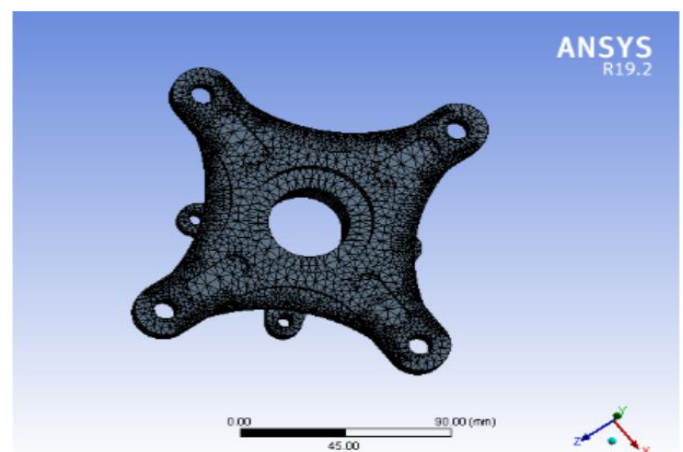

Fig 4: Meshing

5.2 CONSTRAINTS AND LOAD

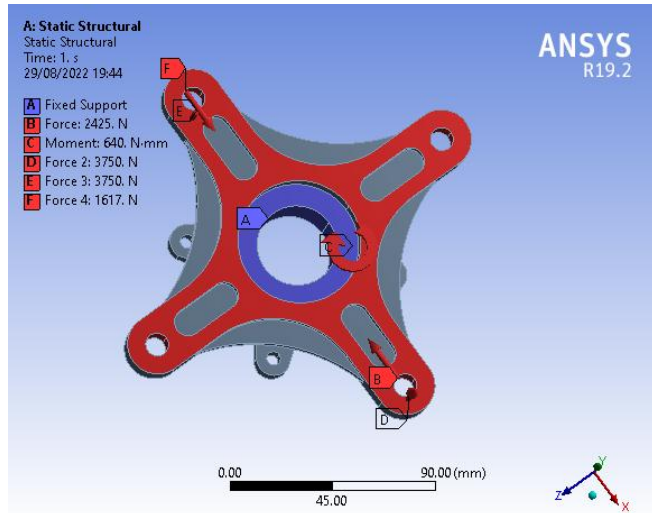Fig 5 shows that forces acting on wheel hub.

Fig 5: Constraints and loads

5.3 RESULTS

The analysis on wheel hub are:

Table -2: Analysis result on wheel hub

Parameter	Max. Value	Min. Value
Deformation	0.26324 mm	0
Equivalent Stress	106.93 Mpa	0
Safety Factor	2.618	0
Fatigue safety Factor	1.722	0

Fig 6: Total Deformation
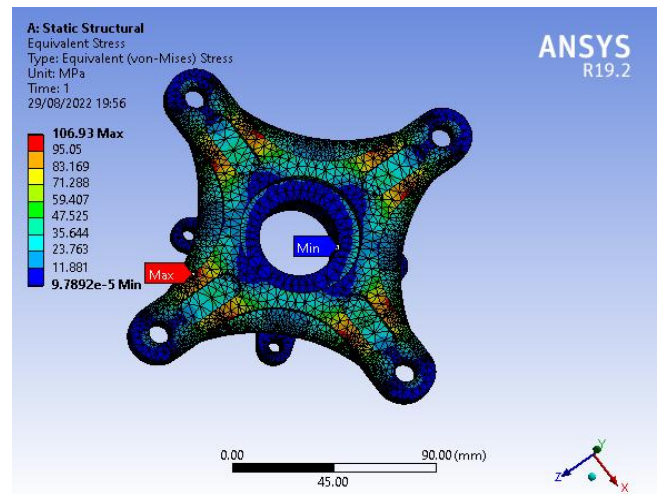
Fig 7: Equivalent Stress

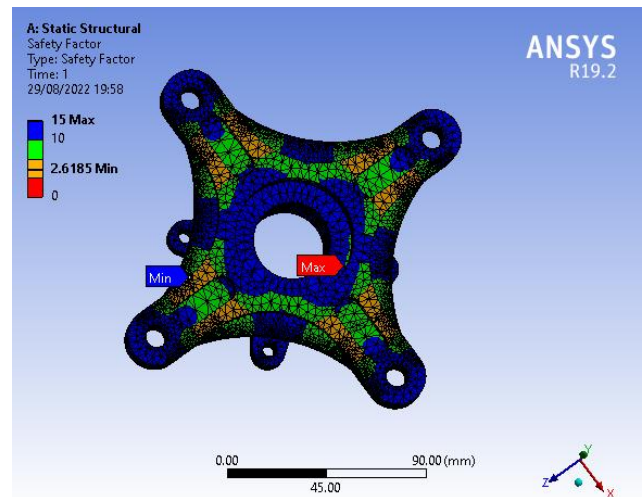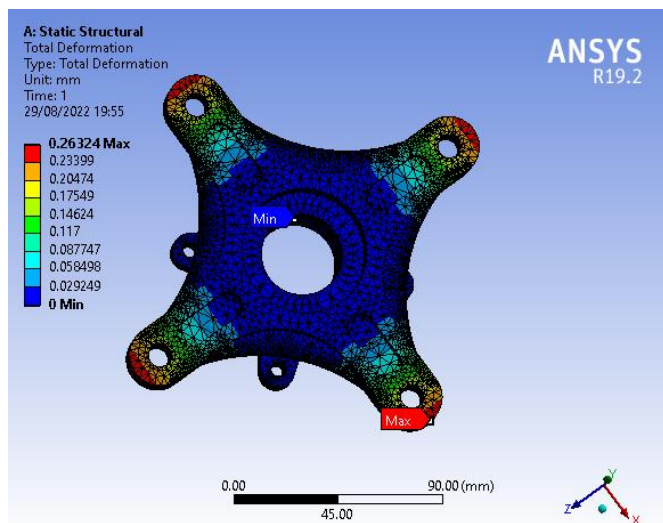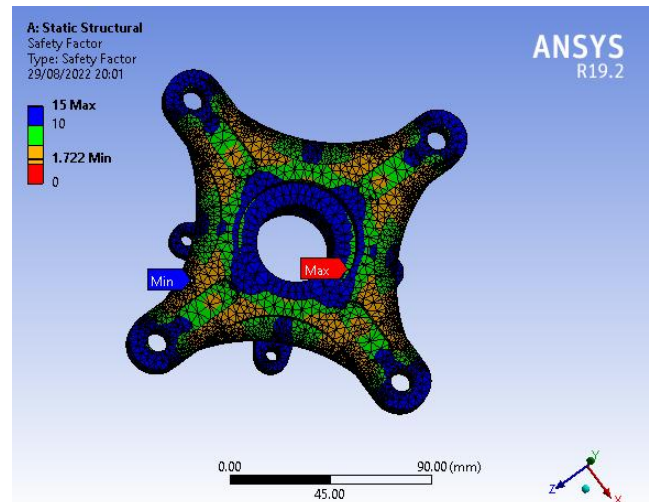**Fig 8: Safety Factor**

Fig 9: Fatigue Safety Factor

3. CONCLUSIONS

In this project the Wheel hub is designe in SOLIDWORKS and done analysis in ANSYS 19.2 for ATV. Aluminium 7075 is sutible material for wheel hub for low weight and easy manufacturing. From the above results, the deformation and stress acting on wheel is minimum. The Factor and safety are also in considerable range. Thus this design is suitable for manufacturing for ATV.

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BIOGRAPHIES

Paresh Nehete, pursuing Btech in the stream of mechanical engineering in Vishwakarma Institute Of Information Technology.