Modeling and Analysis of Wheel Rim Using Ansys

Naveen Kancheti, Atchi Reddy Vemula, Gopi Reddy Gudibandla, Hetesh Krishna P N V Bala Subramanyam

Abstract: ***The 3D model of wheel rim is designed in Solid Works. Then it saved as IGES format where we can import 3D model in to ANSYS.We have done Static analysis in Work-benchfor wheel rim under radial load to find the Total Deformation,maximum Principal Elastic strain, minimum Principal Stress, Equivalent Elastic Strain, Equivalent Stress. The analysis is done for 3 different material properties such as Aluminium, Cast Iron, Structural steel. The application of workbench foranalysing stressdistribution.***

I. INTRODUCTION

The rim is a outer edged part of a wheel it holds the tire is mounted on the vehicle such as automobiles rim analysis on ansys taking the materials such as aluminium, cast iron, structural steel by doing static structural analysis of rim. The ansys workbench is environment is an ability to understand advance finite element method to coordinate with CAD designed software's the workbench will perform the static and thermal analysis of the materials. The material properties and the process of making decision the relationship are considering over those elements are given in terms of unknown values at the element edges. In this static analysis of rim constraints will be applying on the outer edge boundary area of the rim.

II.ANALYSISOFWHEELRIM

The 3D model of wheel rim is import in ANSYS.Then we need to mesh the rim and give the boundary conditions and apply load on component. In that static analysis we have seen- Total Deformation, maximum Principal Elastic strain, minimum PrincipalStress, Equivalent

Elastic Strain, Equivalent Stress under load conditions

1. Importing the model
2. Material properties
3. Meshing of the wheel rim
4. Boundary constraints
5. Load Application

Material properties:

Aluminium:

Young's modulus (E) =72000 mpa

Yield stress=160 mpa

Density =2800kg/m3

Revised Manuscript Received on June 05, 2019

Naveen Kancheti, Mechanical Engineering Department,Koneru Lakshmaiah Educational Foundation

Atchi Reddy Vemula, Mechanical Engineering Department,Koneru Lakshmaiah Educational Foundation

Gopi Reddy Gudibandla, Mechanical Engineering Department,Koneru Lakshmaiah Educational Foundation

Hetesh Krishna, Mechanical Engineering Department,Koneru Lakshmaiah Educational Foundation

P. N. V Balasubramanyam, Mechanical Engineering Department,Koneru Lakshmaiah Educational Foundation

Cast iron:

Young's modulus(E)=1000 mpa

Yield stress=200 mpa

Density=7900 kg/m3

Structural steel:

Young's modulus(E)=200000 mpa

Yield stress=280 mpa

Density=7850kg/m3

III.MODEL OF RIM

We design the rim in solid works as per the dimensions by selecting the front palne and drawing a half section of the rim and giving the as per the dimensions and exit into the workbench selecting revolved command after that selecting the plane drawing a wheel hub and bolt hole in rim.

Outer diameter	16.96 inch
Inner diameter	16.65 inch
Hub hole diameter	1.96 inch
Bolt hole diameter	0.39 inch

IV.IMPORTING THE MODEL

First, we go to static structural by clicking on static structural it will display the small window it shows geometry import(IGES) file into the Ansys.

After that giving boundary conditions and applying default mesh size. Applying load 1mpa and taking the Total deformation, maximum PrincipalElastic strain, minimum Principal Stress, Equivalent Elastic Strain, Equivalent Stress

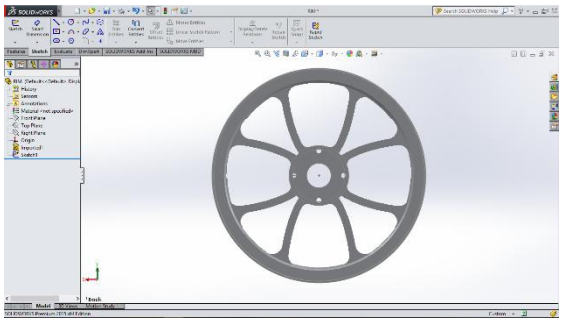

Fig1.Design of RIM

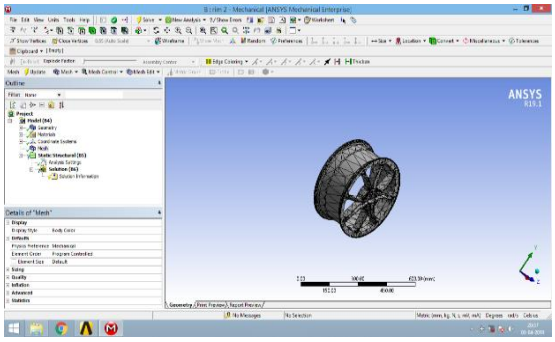

Fig2.Meshed rim in ansys

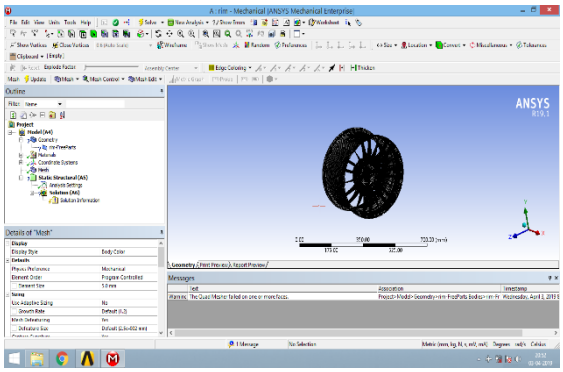

Fig3.Finely meshed in Ansys

2.STRUCTURAL STEEL

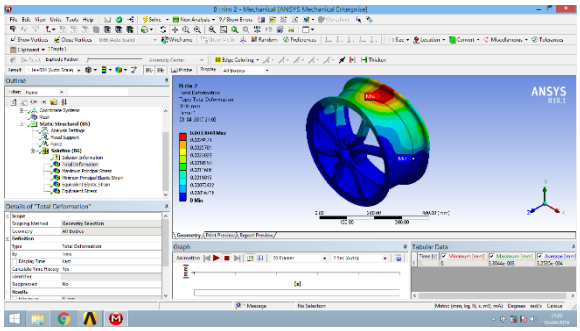

Fig2.1Total Deformation structural steel

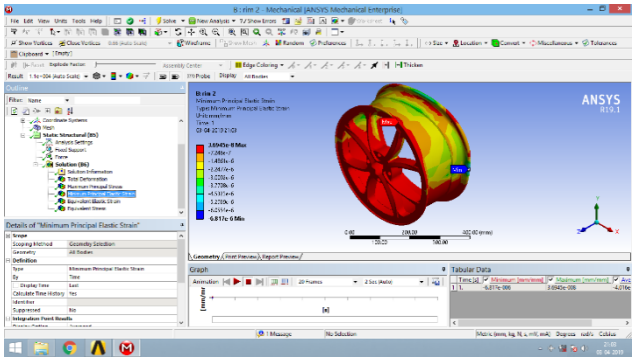

Fig2.2 Max principal Elastic strain structural steel

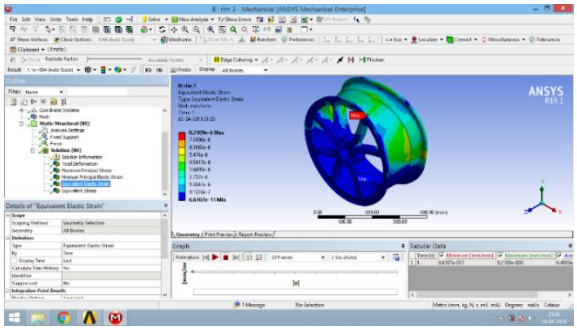

Fig2.3 Equivalent Elastic Strain structural steel

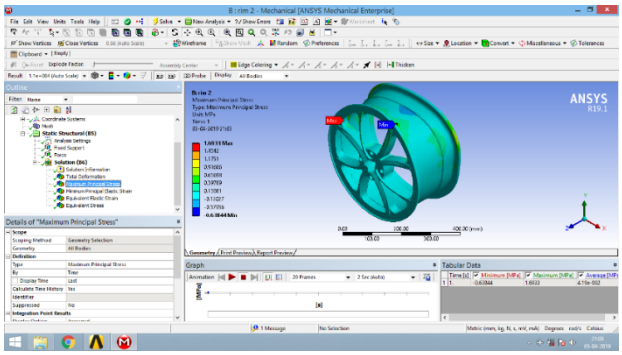

Fig2.4 Maximum Principal Stress structural steel

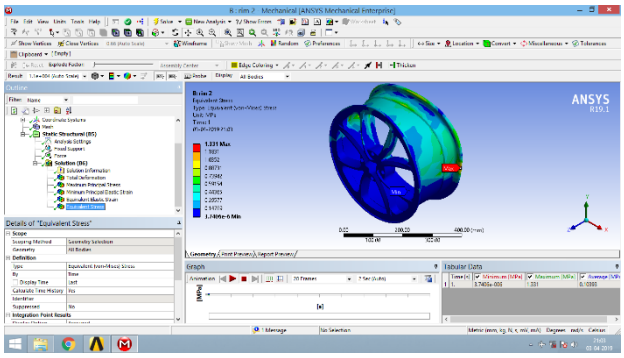

Fig2.5 Equivalent Stress for structural steel

3.ALUMINIUM

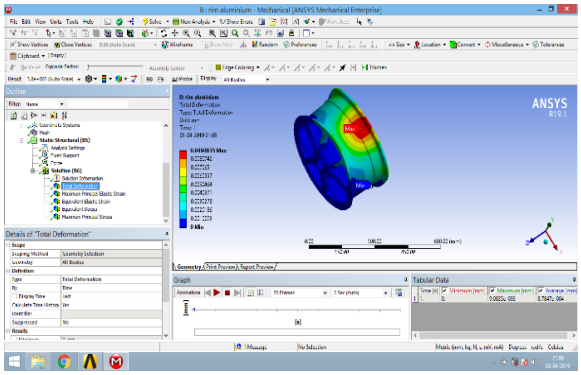

Fig3.1 Total deformation for aluminium

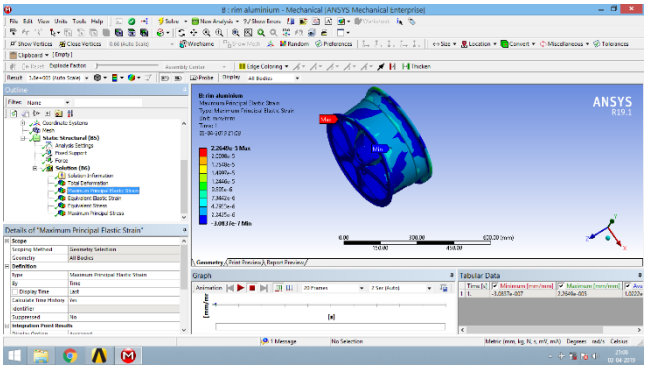

Fig3.3 Max Principle Elastic Strain for aluminium

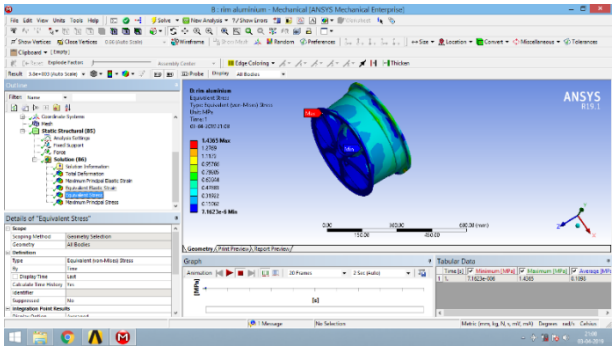

Fig3.4 Equivalent Stress for aluminium

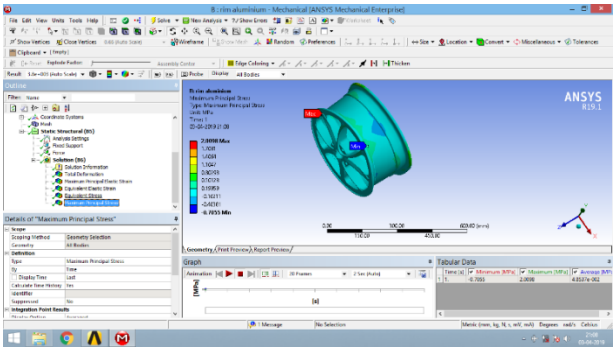

Fig3.5 Maximum Principle Stress for aluminium

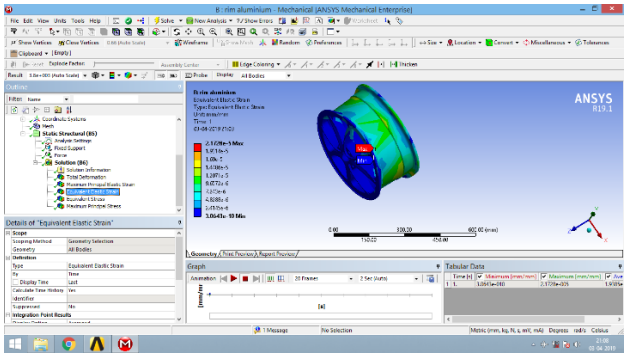

Fig3.2 Equivalent Elastic Strain for aluminium

4.CAST IRON

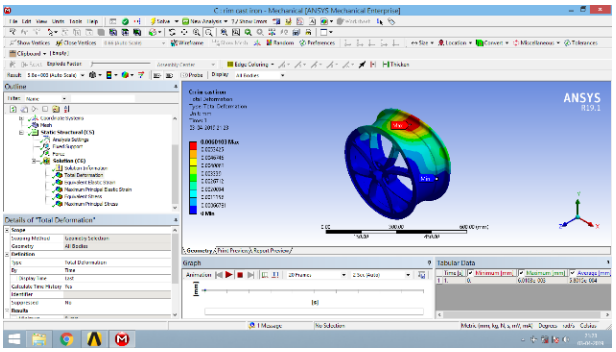

Fig4.1 Total deformation for cast iron

Materials	Total deformation	Maximum Principle Elastic Strain	Equivalent Elastic Strain	Maximum Principle Stress	Equivalent Stress
Aluminium	0.0090835	2.2649e^-5	2.1728e^-5	2.0098	1.4365
Structural steel	0.0033044	3.6945e^-8	8.2109e^-6	1.6933	1.331
Cast iron	0.0060103	1.5306e^-5	1.5185e^-5	1.9476	1.5055

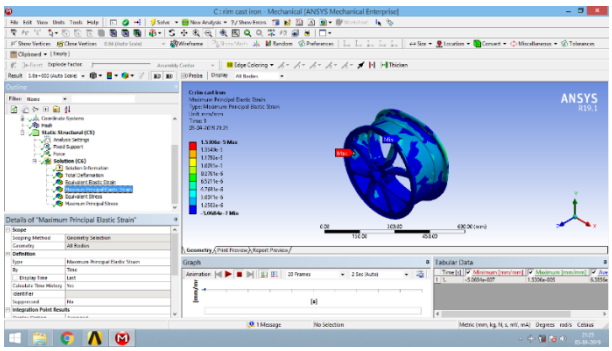

Fig4.2 Max Principle Elastic Strain for cast-iron

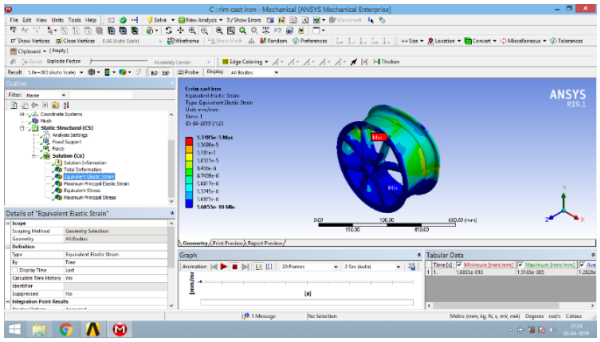

Fig 4.3 Equivalent Elastic Strain for cast iron

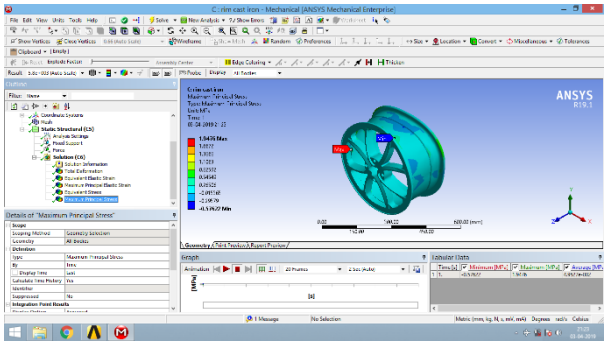

Fig4.4 Maximum Principle Stress for cast iron

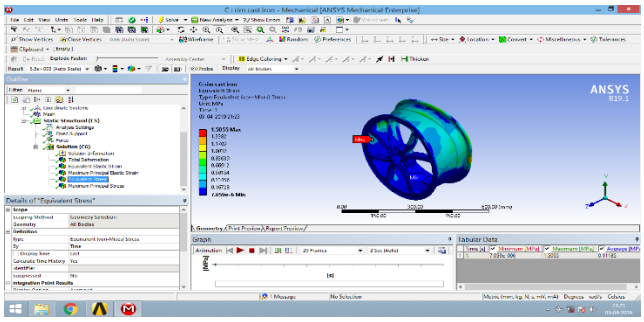

Fig 4.5 Equivalent Stress for cast iron

V. MATERIAL COMPRESSION

VI. CONCLUSION

We perform analysis on wheel rim by taking three material properties where as Aluminium, Cast iron, Structural steel. we found the total deformation values of aluminium, cast iron and structural steel as 0.0090835,0.0060103 and 0.0033044 respectively from the above values structural steel ha less deformation values. Hence we conclude that structural steel can with stand more load compare to other two materials.

REFERENCES

1. https://pdfs.semanticscholar.org/f0d4/4701badf7881efd84fc433aeccd53fecd5a5.pdf
2. https://iarjset.com/upload/2017/september-17/IARJSET%2031.pdf
3. http://www.iosrjournals.org/iosr-jmce/papers/vol12-issue6/Version-5/I012657382.pdf
4. https://www.ijert.org/research/analysis-of-wheel-rim-using-finite-element-method-IJERTV3IS10570.pdf
5. M. Bäcker, A. Gallrein, H. Haga A tire model for very large tire deformations and its application in very severe events SAE Int J Mater Manuf, 3 (1) (2010), pp. 142–151 https://doi.org/10.4271/2010-01-0373, Google ScholarCrossref
6. M. Bäcker, A. Gallrein, M. Roller Noise, vibration, harshness model of a rotating tyre VehSystDyn, 54 (4) (2016), pp. 474–491, Google Scholar
7. Fatigue Analysis of Aluminium Alloy Wheel Under Radial Load, *International Journal of Mechanical and Industrial Engineering (IJMIE)*, ISSN No. 2231–6477, Vol-2, Issue-1, 2012. GoogleScholar
8. Stress Analysis of Wheel Rim *International Journal of Mechanical Engineering and Research* Volume 1 Issue 1, (Page, 34–37), ISSN: 2277-8128. Google Scholar