INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact Factor: 6.078

(Volume 7, Issue 2 - V7I2-1509)

Available online at: https://www.ijariit.com

Study of the impact of mesh size for static structural analysis of motorcycle wheel

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ABSTRACT

Mesh size has a significant effect on finite element analysis of Motorcycle Wheel. The purpose of this study is to analyze those effects in detail and study their impacts on the results of static structural analysis of the Motorcycle Wheel. Importance of wheel in the automobile is obvious. The vehicle may be towed without the engine but at the same time even that is also not possible without the wheels, the wheels along the tire has to carry the vehicle load, provide cushioning effect and co pe with the steering control. Generally wheel spokes are the supports consisting of a radial member of a wheel joining the hub to the rim. The most commonly used materials for making Wheel spokes are with features of excellent lightness, thermal cond uctivity, corrosion resistance, characteristics of casting, low temperature, high damping property, machine processing and recy cling, etc. This metal main advantage is reduced weight, high accuracy and design choices of the wheel. This metal is useful fo r energy conservation because it is possible to recycle. Spokes make vehicles look great but at the same time they require attenti on in maintenance.

Keywords: *Mesh, Finite Element Analysis, Motorcycle Wheel, Static Structural Analysis.*

1. INTRODUCTION

Finite element Analysis (FEA) is the use of Finite Element Method (FEM) to study and analyze various phenomena. Finite element method involves the solving of various differential equations in engineering numerically. Finite element analysis uses this method to solve them by using a computer model such as ANSYS. FEA is widely used to calculate different mechanical parameters acting on a component such as heat and mass transfer, stress and strain, fluid dynamics etc. Finite Element Analysis has a very significant importance as it helps analyze and understand the effects of various parameters on any component or a part or an assembly and thus defining its accuracy. The fixed support has been given to half of the wheel bottom.

1.1 Method of Study

Static structural analysis has been performed on Motorcycle Wheel. It plays a significant role in determining the effect of load on any component or a part. Many different fields such as applied mechanics, Mathematics, Material Sciences are used to determine various parameters such as stress, strain, deformation, stability of the component etc. While performing the analysis, effects of mesh size are studied as it has an important role in determining accurate results. To do this, meshing method has been considered.

In meshing tetrahedron method has been used. It divides the mesh structure into curved regions till the individual mesh elements into tetrahedral structure .Three size has been chosen to do this analysis. 10mm,15mm,20mm are the sizes has been tsken for the analysis.

The study has been performed on a Motorcycle Wheel. They have two ends out of which one end is open and the other end is a closed loop. Fig-1 below shows a Motorcycle Wheel.

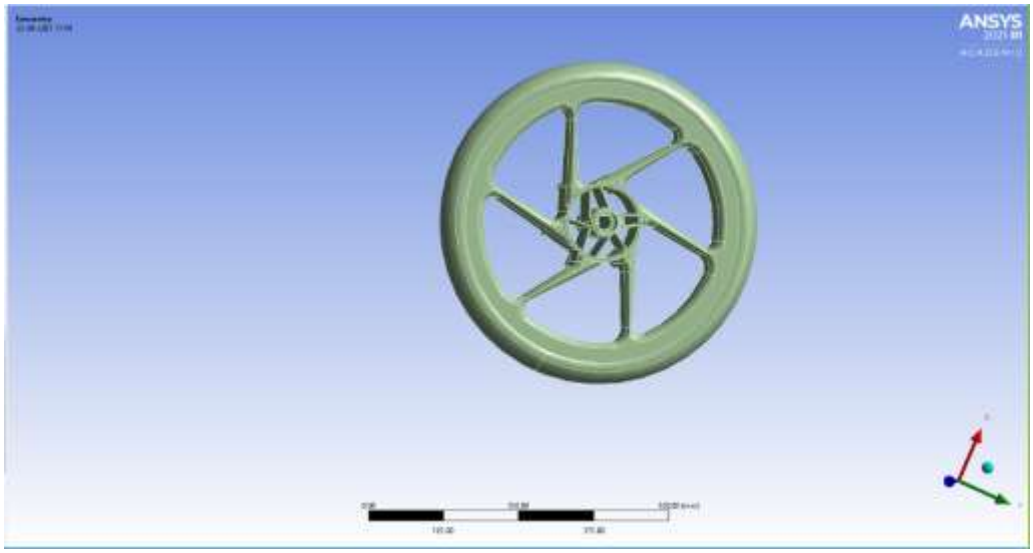
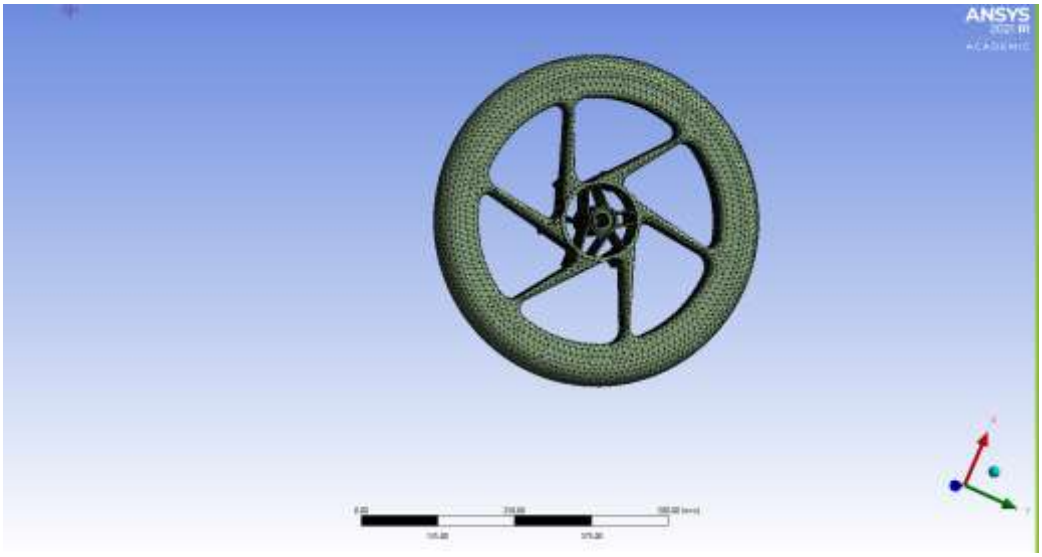


Fig-1: Motorcycle Wheel

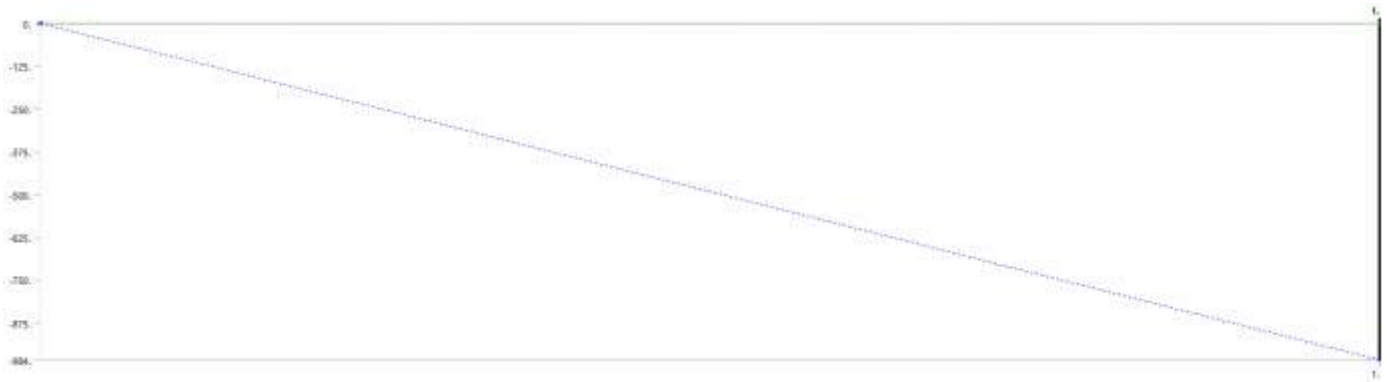
Meshing

In Finite Element Analysis (FEA) the goal is to simulate some physical phenomena using a numerical technique called the Finite Element Method (FEM). To quantify physical phenomena such as wave propagation or fluid flow we must use mathematical equations



2.1 Graphical Representation of Force

Below shown is the graphical representation of forced applied to the spanner with a time lapse of 1s. As the force is applied in negative direction i.e -984N, following graph is obtained.



Graph-1 : Graphical force Representation

2.2 Tetrahedron – 10mm

The total deformation ,equivalent stress and strain are shown in the Fig-3 , Fig-4, Fig-5 respectively. The results for static structural analysis showing maximum and minimum total deformation as well as equivalent stress are shown in the Table-1 below.

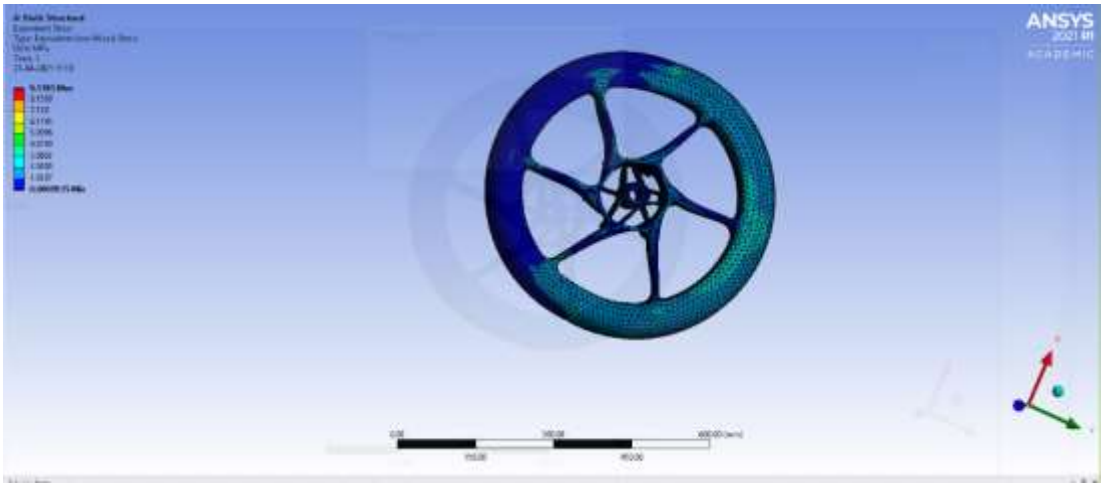


Fig-3 : Total Deformation

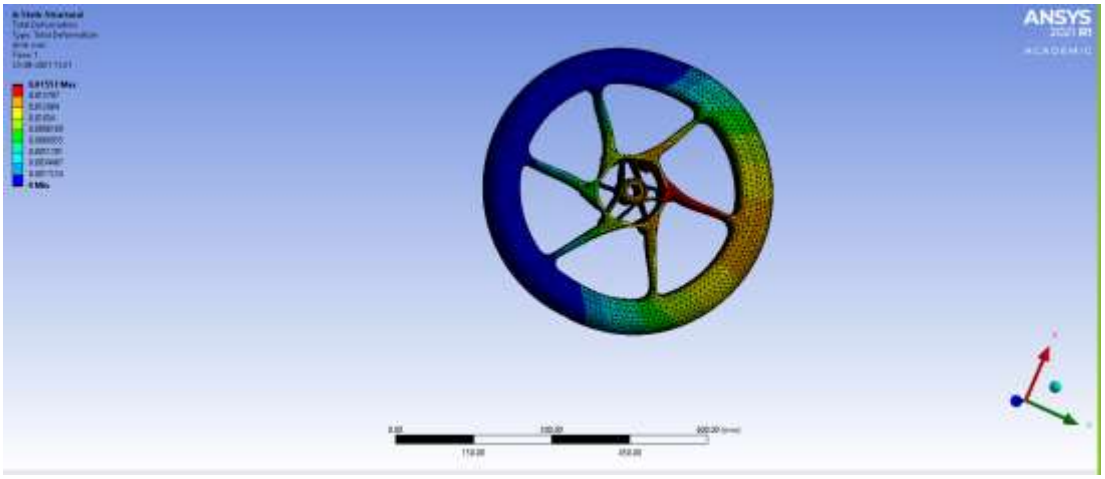


Fig-4 : Equivalent Stress

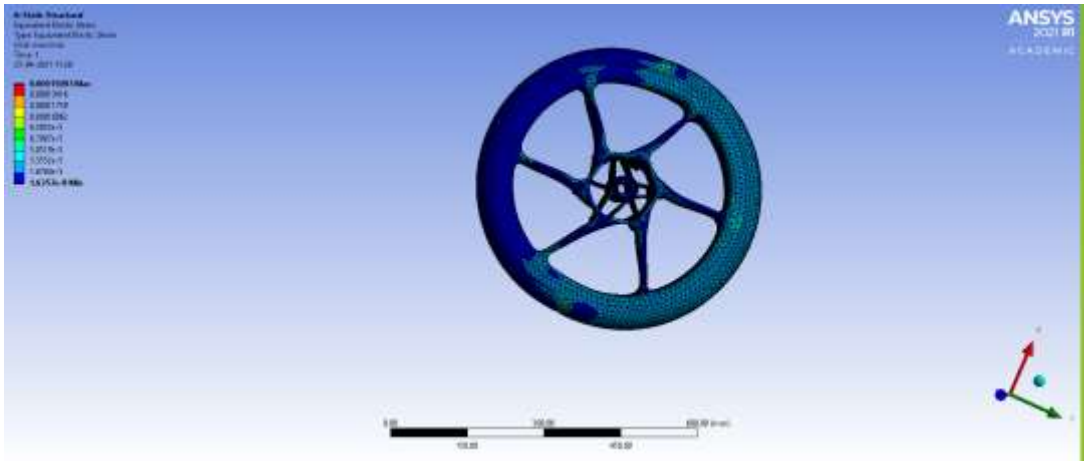


Fig-5 : Equivalent Stain

Table-1: Static Analysis Results

	Total Deformation	**Equivalent Stress**	**Equivalent Strain**
Maximum	9.1785mm	0.01551 MPA	0.00013416
Minimum	0.0009535mm	0 MPA	1.6357e-8

2.3 Tetrahedron – 15mm

The total deformation ,equivalent stress,strain are shown in the Fig-6 and Fig-7 ,Fig-8 respectively. The results for static structural analysis showing maximum and minimum total deformation as well as equivalent stress are shown in the Table-2 below.

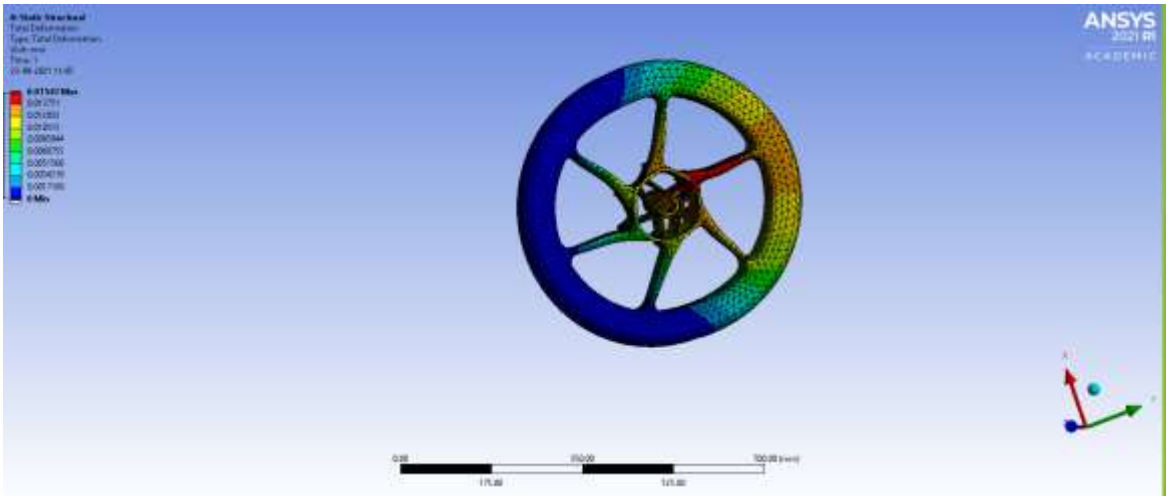


Fig-6 : Total Deformation

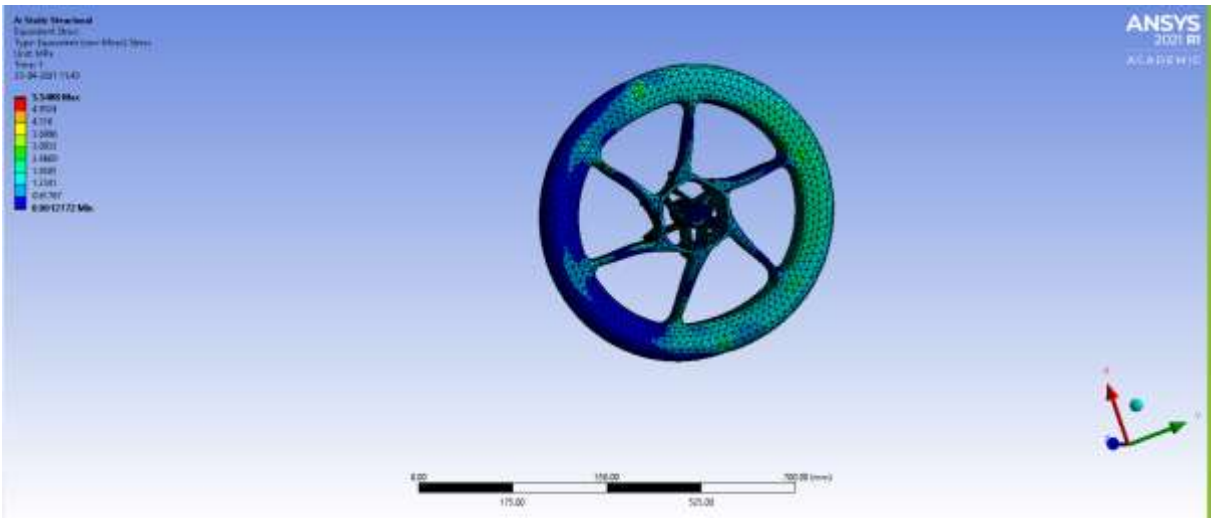


Fig-7: Equivalent Stress

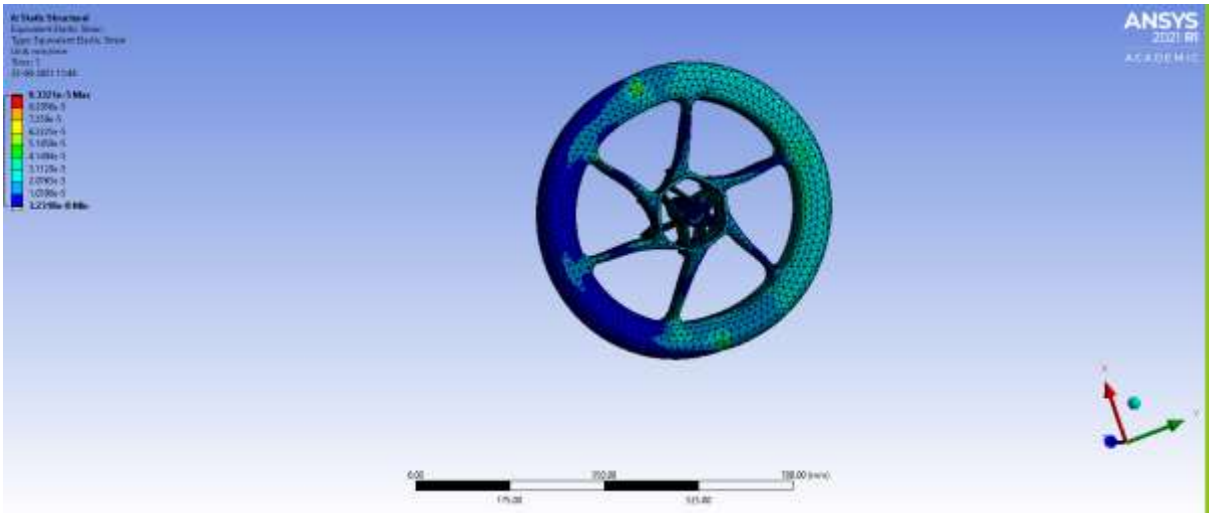


Fig-8 : Equivalent Strain

Table-2: Static Analysis Results

	Total Deformation	**Equivalent Stress**	**Equivalent Strain**
Maximum	0..01547 mm	5.5488 MPA	9.3321e-5
Minimum	0 mm	0.0012772 MPA	3.2318e-8

2.4 Tetrahedron – 20mm

The total deformation ,equivalent stress,strain are shown in the Fig-9 ,Fig-10 and Fig-11 respectively. The results for static structural analysis showing maximum and minimum total deformation as well as equivalent stress are shown in the Table-3 below.

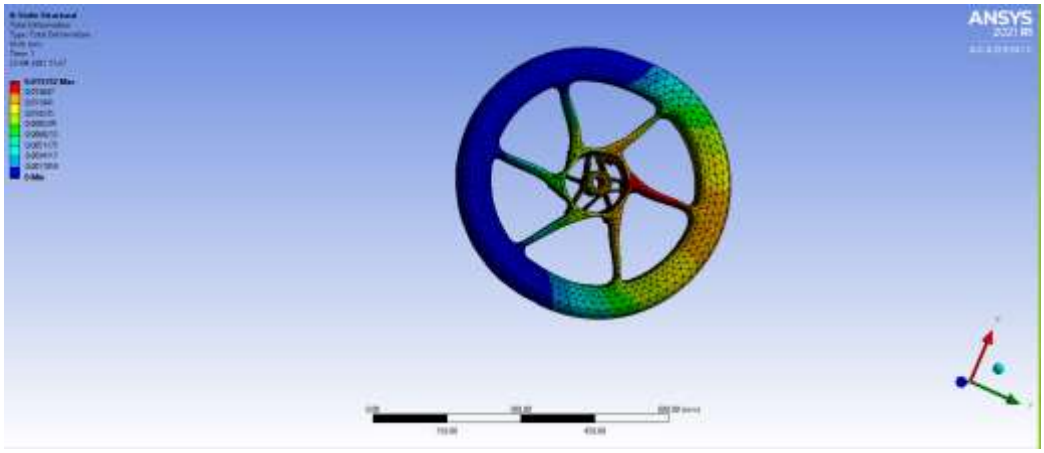


Fig-9 : Total Deformation

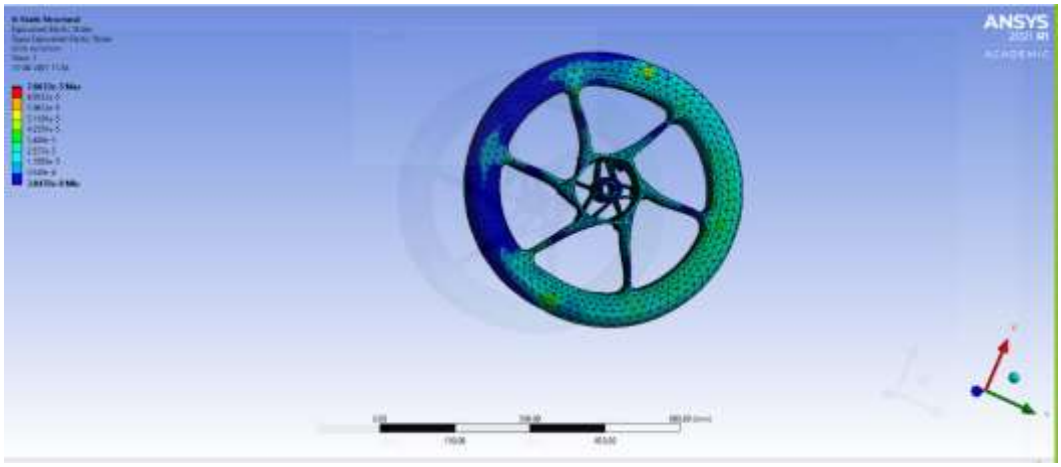


Fig-10 : Equivalent Stress

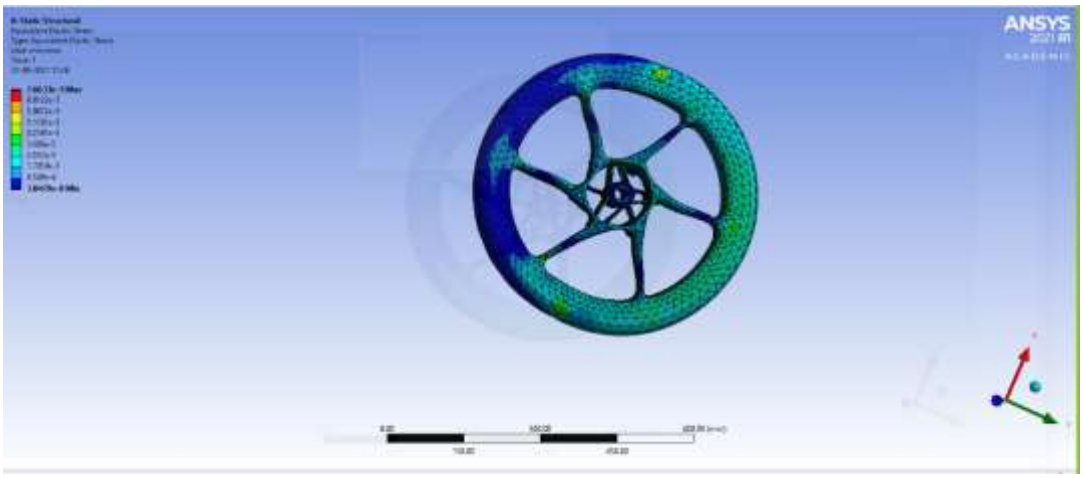


Fig-11: Equivalent Stain

Table-2: Static Analysis Results

	Total Deformation	**Equivalent Stress**	**Equivalent Strain**
Maximum	0.015352 mm	4.4929 MPA	7.6633e-5
Minimum	0 mm	0.0013792 MPA	3.8479e-8

3. CONCLUSION

In this study we performed static structural analysis on Motorcycle Wheel and also studied the effects of mesh size on the component. From the results it can be concluded that on changing the mesh size, there is a change in the result obtained. When a force of - 984N is applied on, the results for total deformation and equivalent stress also change. The total deformation and equivalent stress are higher in 10mm tetrahedral meshinng. Also it can be concluded that by changing the span centre angle during meshing, the n and elements present also changes. All the total deformation ,equivalent strain .equivalent stress have obtained the maximum and minimum values . The above results also lead us to a conclusion that smaller the meshing present, more accurate is the result. Increase in accuracy, increases the simulation thus increasing the solve time.

4. ACKNOWLEDGEMENT

I would like to express my sincere gratitude towards Dr. Atul P. Kulkarni sir for his constant guidance and support in make this research paper possible.

5. REFERENCES

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