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Design and Analysis of Deformation of Alloy Wheel Rim for Motorcycle

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Abstract- This project focuses on wheels and tires for the automobile industry. Alloy hoops are made of an aluminum alloy. This design and analysis of the wheel rim is modeled and imported into ANSYS using the IGES format. The wheel is perhaps the most important discovery of the old days. Wheels are classified as a safety critical component and international codes and criteria are used to design a wheel. This experimental and analytical method for structural analysis is strain gauge and finite element method. In this analysis, different types of wheels and their functions are performed.

Keyword: Wheel; Rim,**;** Finite element analysis; design.

1 INTRODUCTION

It is necessary to analyze complex structures, when so simple. There are three processes involved which are pre-processing, analysis and visualization. The material chosen was an aluminum alloy, magnesium alloy, titanium alloy. Aluminum alloy is better than conventional steel wheels in strength and durability. It has excellent wear resistance, anti-corrosive properties and longer service life estimated by voltage frequency distribution. The analysis is made with the maximum load that can be applied to the rim. The rear wheel and front wheel have their own maximum load that can be supported. It was verified that the analysis stress is still in the range of the yield limit of the aluminum alloy. Offset is at low value. This project is still in safe condition. As technologies advanced, manufacturers tried to provide vehicles that were faster, stronger and lighter in construction and, for that, the basic production materials needed to change. Alloy is a composite made from aluminum or magnesium or a combination of both, which has brought many benefits by including a lighter material with very little compromise on strength.

Alloy wheels, also known as rims, are made from aluminum or magnesium alloys. It sometimes happens that a mixture of aluminum and magnesium is used in the manufacture of alloy wheels. The basic advantages of using alloy wheels are that they are lighter, provide better heat conduction and also add to the look of the motorcycle. People who wear alloys can enjoy certain advantages, but that doesn't mean that spoked wheels are useless. In fact, pull wheels are still in vogue because of some perks here. Both types of wheels, ie alloy and spoke, have certain advantages. In this article, we'll evaluate alloy wheels in terms of performance, durability, and more.

The importance of wheels and tires in the automobile is obvious. Without an engine, the car can be towed, but even that is not possible without wheels. The wheel together with the tires must support the vehicle load, provide a dampening effect and handle steering control. Alloy wheels are automobile wheels made from an alloy of aluminum or magnesium metals, or sometimes a mixture of both. The difference between the rim of light alloy wheels and the normal steel rim is due to its low weight, which improves the path and speed of the car. Initially, alloy wheel rims were made of magnesium alloys. Despite losing approval on regular vehicles, they remained famous in the 1960s, the work noted that a method of predicting the fatigue life of aluminum alloy wheels was proposed to ensure their durability in the initial design phase.

2. LITERATURE REVIEW

According to Karthik A.S. et al. (2016) Finite Element Techniques are used to discover the distribution of stress and displacement in vehicle wheels subjected to increased pressure and radial load. The model was made using “CATIA V5” and the analysis was done using the finite element package “Ansys workbench”. After comparing the results of different models of selected materials, such as magnesium, aluminum and titanium, are used to check the capacity of the wheel. According to Jaspreet Singh, et al. (2015) they analyzed alloy wheel by static loading using Ansys15.0 and the summer of this article was, FEA was performed on aluminum alloy wheel. The results of vonmisses tension, safety factor and total displacement were calculated. The use of reverse engineering results is also suitable for the project. According to Meghashyam-et.al (2013) the wheel rim model was created with the help of CATIA software. Subsequently, this CATIA model was imported into ANSYS for analysis work. With the help of ANSYS software the different forces, pressure acting on the component and also for calculating the results. The ANSYS static analysis work was done for

two different materials taking into account aluminum and forged steel and their relative performances were observed, respectively.

3. ALLOYWHEELMODEL

In modern metal component manufacturing, we must accept the premise that design dictates performance, and that the role of the designer is fundamental. In addition, the designer must have robust and proven databases and failure criteria. However, as design dictates performance, performance itself is achieved through alloy and process selection; both are quite interconnected and coupled to each other Historically, new processes have been developed, but these have always been evaluated based on existing alloys rather than developing new alloys to take advantage of processing attributes to optimize this alloy and process coupling. Over the last decade, we've witnessed the development of tools that can be used to optimize alloy development.

4. FUNCTIONS OF A WHEEL RIM

In its basic form, the wheel rim is a transfer element between the tire and the vehicle. Following are the main functions of a wheel rim: Transfers torque (braking and acceleration).

1. Support mass
2. Adds mass
3. Dissipates heat
4. Adds value

5. METHOD-FINITE ELEMENT METHOD

The finite element method (FEM) is a widely used method of solving quantitative problems in engineering and mathematical modeling. FEM is a standard pricing method for solving split equations with two or three spatial variables (eg, other boundary value problems). To solve the problem, FEM breaks a large system into smaller, simpler components called finite elements. This is achieved by determining a certain space in the space size, which is used in constructing the object: the base number of the solution, which has a few points. The formation of a moderate object of the limit number problem ultimately results in an algebraic

mathematical system. The method estimates anonymous activity in a domain. Simple calculations that measure these finished items are collected into a large-scale measurement system that measures the entire problem. FEM then approaches the solution by reducing the error function associated with a variance calculation.

6 RESULTS AND DISCUSSION

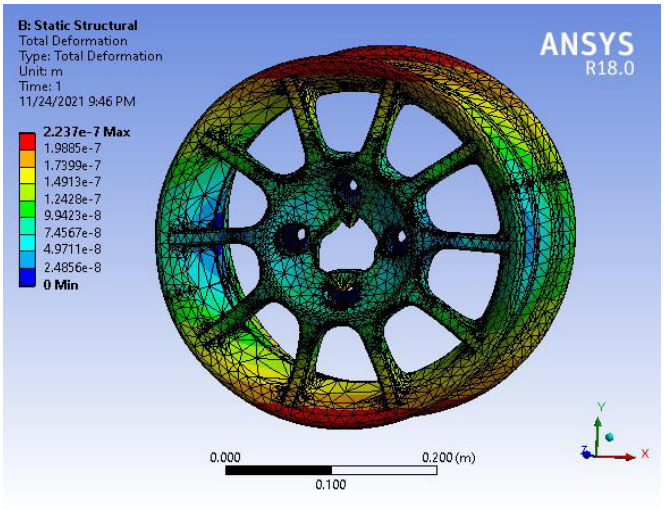

Figure 1 Total Deformation

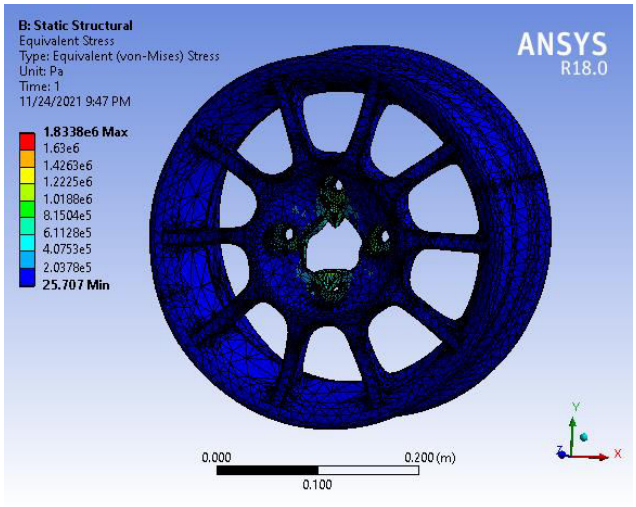

Figure 2 Equivalent Stresses 1

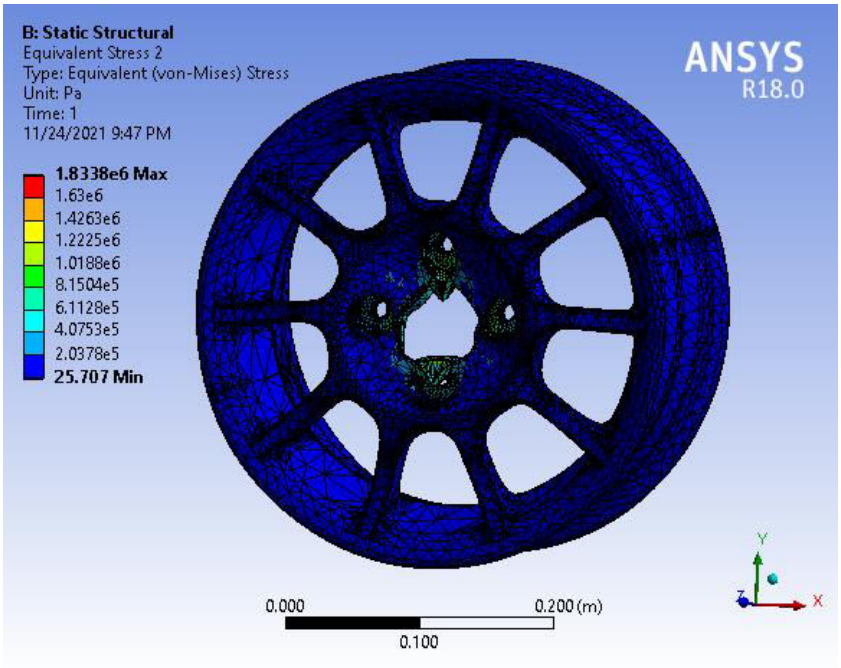

Figure 3 Equivalent Stresses 2

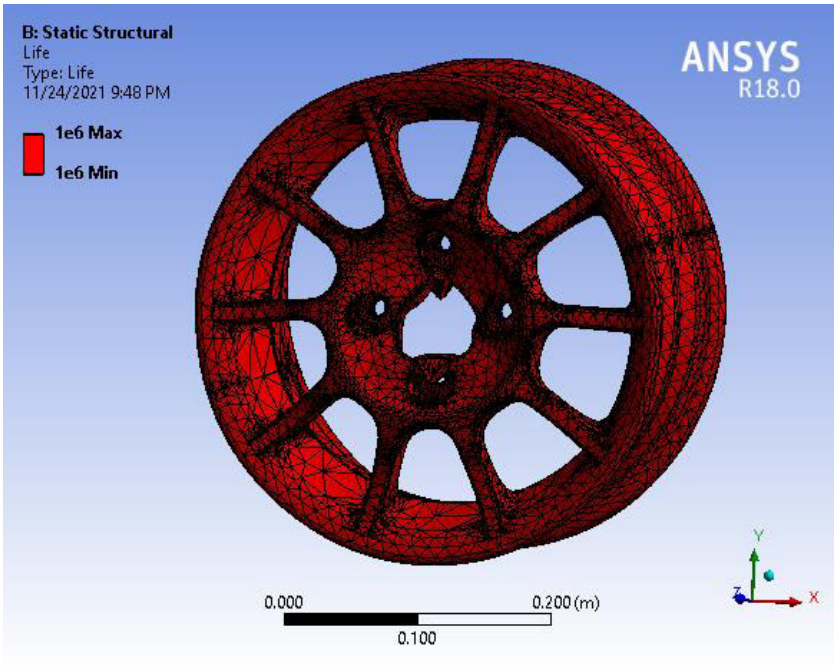

Figure 4 Life

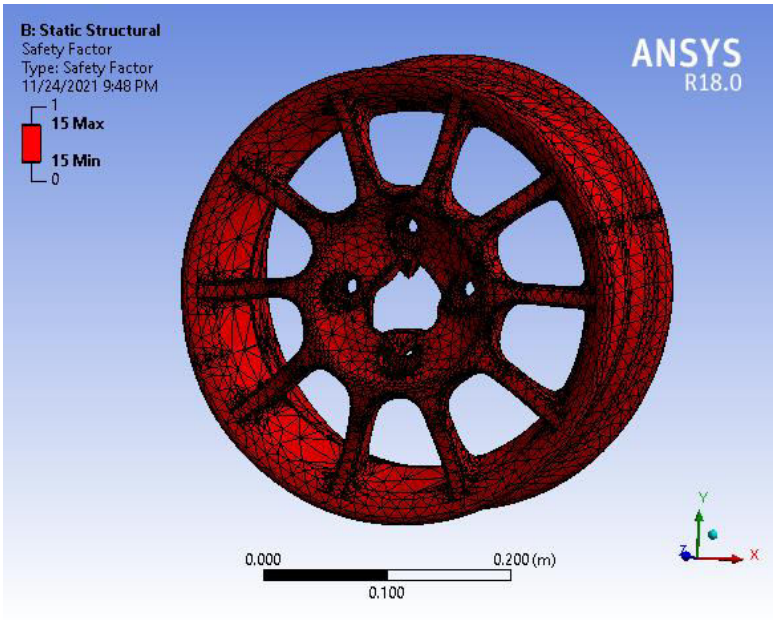

Figure 5 Safety Factor

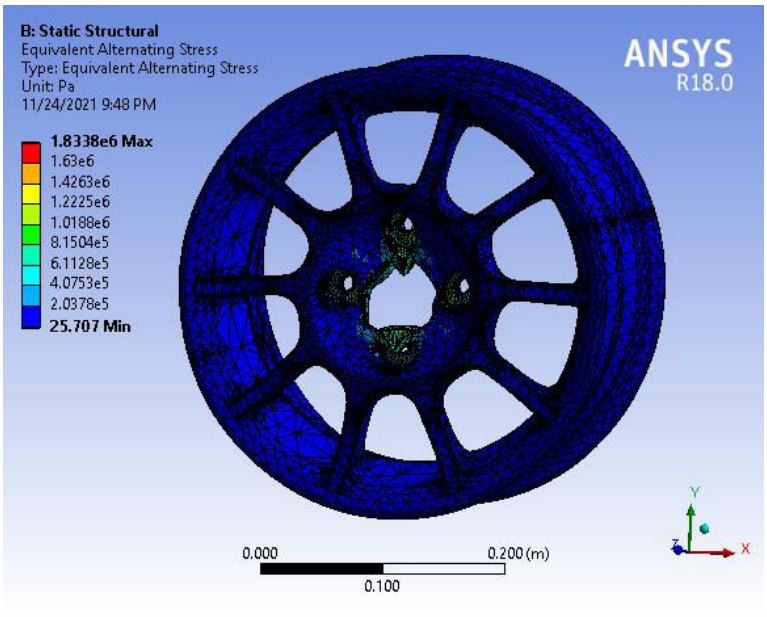

Figure 6 Equivalent Alternating Stresses

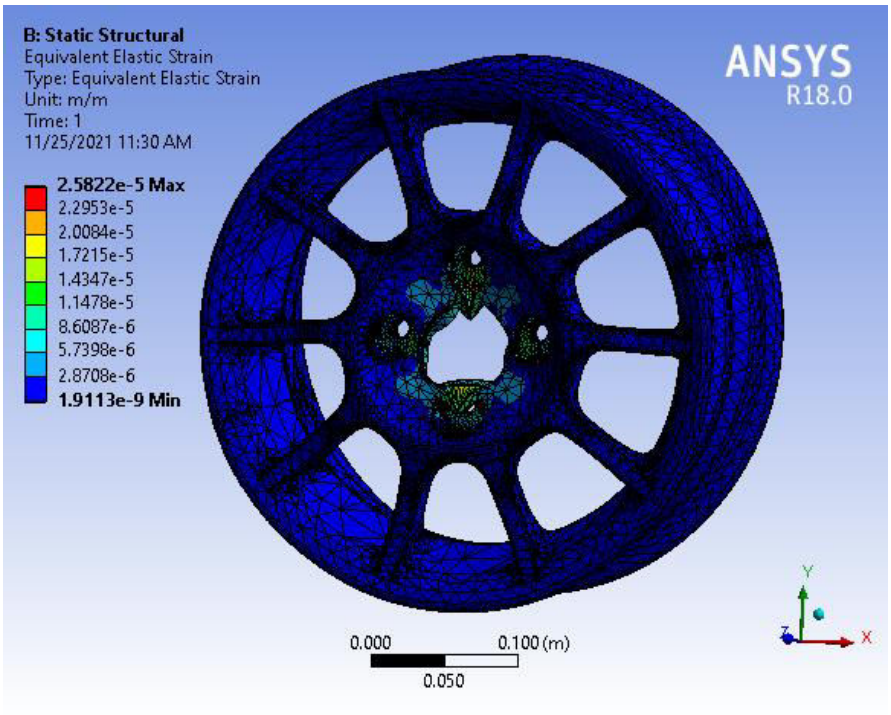

Figure 7 Equivalent Elastic Strains

7 CONCLUSIONS

In the final design and analysis, we determined the quality and length of the rim from the wheel types. The design and detail is done by the software. In addition, a part of the structural analysis was performed and performance was observed. In this case, the results of the experimental and experimental studies were observed. Total Deformation (2.237 X 10^{-7} M), Equivalent Stresses 1 (1.8338 X 10^{6} Pa), Equivalent Stresses 2 (1.8338 X 10^{6} Pa), Life (1 X 10 6 Maximum), Safety Factor (15 Maximum), Equivalent Alternating Stresses (1.8338 X 10^{6} Pa) and Equivalent Elastic Strains (2.5822 X 10^{-5} m/m) are shown in Figure 1-7 respectively.

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