

# Comparative Analysis of Automotive Wheel Rim by using different materials

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**ABSTRACT:** The wheel is one of the important part for good performance of a vehicle. It gives efficient movement for object over a surface Now a day they are using different kind of metal configurations for modern vehicles. Wheels are mainly a blend of aluminium and its components. Alloy wheels reduce weight of vehicle. In this work the design will be done by using CATIA software. We are having two variants in rims Solid rim and modified spoke rims. In this I investigated about how to optimize the hubs by using finite element analysis. Here I used and analysed three composite materials (magnesium, aluminium and steel) Through ANSYS. Finally, I validated experimental results.

**KEY WORDS:** Alloys, wheel rim, optimization, composite material, strain analysis

## INTRODUCTION

### 1.1 WHEELS

The most punctual wheels were made of a strong bit of wood. In its crude frame, a wheel is a round square of a hard and strong material at whose middle has been drilled a roundabout opening through which is set a pivot bearing about which the wheel turns when a minute is connected by gravity or torque to the wheel about its hub, haggles along these lines making together one of the six basic machines. At the point when put vertically under a heap bearing stage or case, the wheel turning on the flat hub makes it conceivable to transport substantial burdens; when set on a level plane, the wheel turning on its vertical hub makes it conceivable to control the turning movement used to shape materials (e.g. a potter's wheel); when mounted on a section associated with a rudder or a suspension mounted on different wheels, one can control the course of a vessel or vehicle (e.g. a ship's wheel or directing wheel); when associated with a wrench, the wheel delivers or transmits vitality (e.g. the



Figure.1. Reference Hub Model

flywheel).



## 1.2 TYPES OF WHEELS

Alloy wheel: Its mostly used in cars, Motorcycles, Trucks. This made of combination of alloy aluminium and magnesium metals.

- It has lighter in weight
- Good conductor
- Improve strength and performance
- Good handling

ALUMINIUM ALLOY WHEEL: Its most common material for preparing wheels. It has good features like thermal conductivity and corrosion resistance. The best one is its having high accuracy and modular weight.

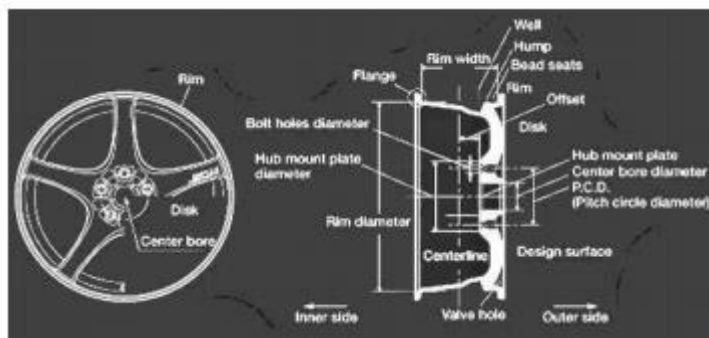
MAGNESIUM ALLOY STEEL: Its has good stability and good impact Resistance. Its having high strength and good casting ability. Its facilitate n damping from noise emission.

- Light weight
- High corrosion
- Low density
- High range performance

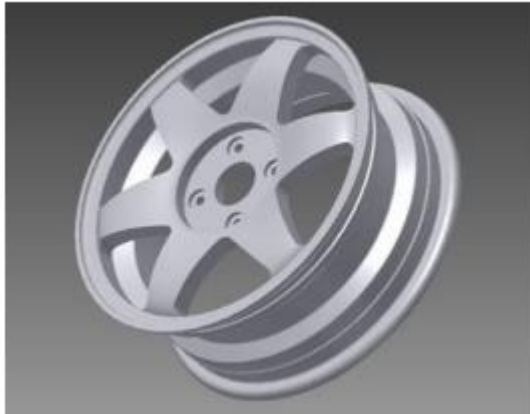
Further the automobile industry is mainly concentrating and putting efforts to reduce weight. Hence cast and forged alloys are essential for the design.

### Problem statement:

The failure of rim wheel is due to fatigue failure. For the improvement of fatigue life, the material optimization and design optimization to find parametric design which gives better fatigue rate.so we experiment and analyse the stress strain and deformation values for different kinds of materials.



### Wheel specifications



**3D Model**

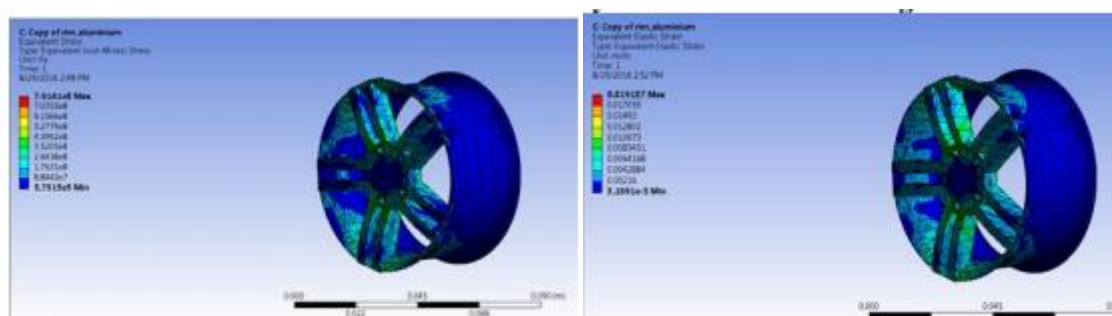
### III. OBJECTIVE

1. To design automotive wheel rim.
2. To study the fatigue life of a rim
3. To study literature review of various works reported
4. Comparison of materials for different alloy materials
5. To optimise thickness of rim and to reduce the material consumption
6. To develop the experimental set up for proposed wheel rims.
7. To compare experimental values

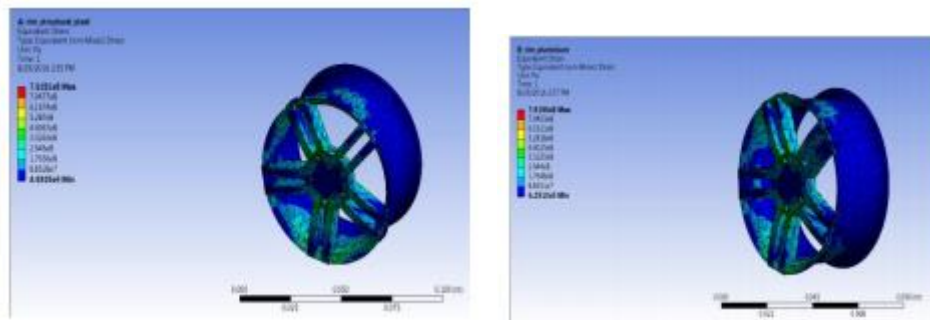
### IV. METHODOLOGY

Here my work was done in two phases. The first phase is literature survey of fatigue analysis. Hereby I done design and optimization analysis. Next I analysed stress strain and other parameters and various car rim geometry and different loading conditions will impose. Cad model is created using various tools in CATIA v5.

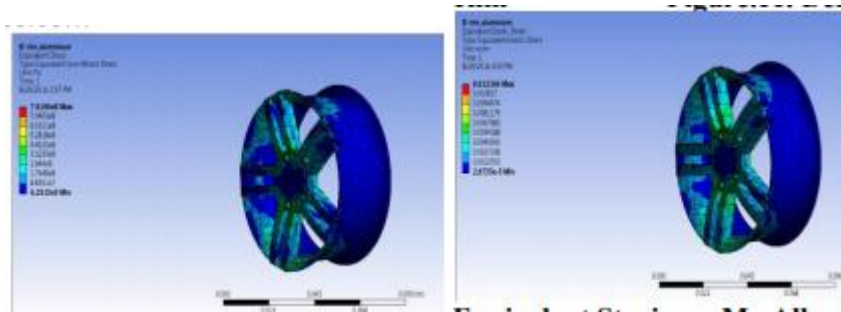
For finding the variation the analytical calculations are done for some cases through finite element analysis. It's a powerful tool for numerical procedure to obtain solutions for engineering analysis. We can find a complex region for complex regions into simple geometric shapes. Its all done by finding loading and boundary conditions



Stress and strain for aluminium alloy

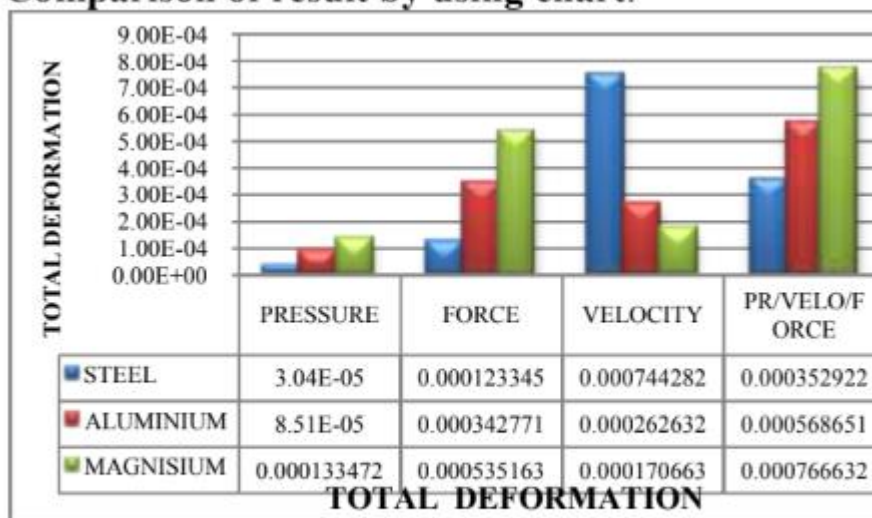


Stress and strain for steel alloy



Stress and strain for magnesium alloy

### Comparison of result by using chart.



Graph : Variation in Total Deformation due to change of boundary condition and Materials.

Table

	Material Used		
	Al alloy	Steel	Mg alloy
Stress	7.8146e8	7.928e8	7.829e8
Deformation	0.001287	0.00029	0.00072
Strain	0.019187	0.00432	0.01216

## CONCLUSION

The modelling is done by using CATIA and import the file into ANSYS for software analysis. The results are tabulated by comparing in the above table. Hereby we came to know that Mg alloy having less stress compared other two materials. The wheel design with Mg alloy material is optimised in order to withstand the existing load of the vehicle with factor of safety with least quantity of manufacturing cost and losses. IN this the life expectancy will increase and we are having the flexibility and efficiency to resist the impact forces. When weight of the rim reduced the overall efficiency will be increased.

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