



A Review Paper on Cars wheel Rim based on different Approach

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ABSTRACT

The car wheel rim's function is to provide a stable surface for the tyre to be mounted. Its dimensions & shape must be adequate to accommodate the specific tyre that the vehicle needs. This study takes into account a tyre on a car wheel rim that comes within the disc wheel category. Design is a significant industrial process that impacts the product's quality. El rim is made utilizing modelling software at the time. The time required to create intricate 3-D models and the risk associated with the manufacturing and design processes can both be significantly reduced by modelling. So software is employed to produce the wheel rim modelling. These papers showcased several design elements and approaches for wheel rims. The survey is regulations to ensure proper direction and work already done by different researcher.

Keywords: Creo 4.0, Structural Steel, Wheel Rim, Shape, Complexity & Methodology

Introduction

The tyre and wheel assembly has an influence on the operation and performance of the vehicle since the tyre only works as a wheel once it is connected to the rim and inflated. The tyre is made to fit a typical rim, and once it is mounted on the proper rim, it will function at its optimum levels. It goes without saying that if a tyre is mounted on an inappropriate rim, its duration will be shortened. The cylindrical component where the tyre is mounted is known as the rim. The term "wheel" refers to the combination of a rim and a disc plate. The component transforms into a disc after the disc cover is fitted within the cylinder.

Literature Review

Monika Namdev May 2022 The structural analysis uses applied forces of 1000N for the distant force and 245kPa for the pressure on the wheel. As a consequence, when comparing wheels based on total deformation, alloy wheels outperform steel wheels, and when comparing both kinds of alloy wheels, a multi-spoke alloy wheels outperforms a 6-spoke alloy wheel. The figure clearly demonstrated the total deformation maximum value of 0.00155mm minimum at the base of the wheel or outer perimeter of the wheel rim for an 8-spoke alloy wheel with a 55° Y spoke angle. Given that alloy wheels have major disadvantages, take that into account. In terms of structural tendency, alloy wheels outperform steel wheels, and if the spokes are present, both static and dynamic analysis of the wheel rim can be performed. Car weight can be taken into account for static loads, while accelerated load can be taken into account for dynamic loads. Harmonic excitation can be taken into consideration for practical realistic conditions. Three different materials can be chosen from, and all the aforementioned criteria can be compared using the Ansys software to determine which material is the best. [1]

G.Ashokkumar: Dec -2016 Two different materials, forged steel and aluminium, are taken into account for the static analysis work done by ANSYS, and their differential performances have been noted accordingly. In addition to this, the performance of the rim is evaluated after it has undergone vibration analysis (also known as modal analysis). Forged steel is recommended as the optimum materials for this particular project on the static and modal analytical results that were obtained. Compared to forged steel, aluminium wheel rims are exposed under more stress. 2. Von-Miss stresses are lower in both circumstances than ultimate strength. 3. Aluminum exhibits more lateral deformation than forged steel [2]

Ashish June – 2021 Polymer Nano composites are lightweight and strong, which contributes to increased fuel efficiency. Carbon fibre is an excellent composite material for designing wheel rims. There are 2 different types of carbon fibre considered: Epoxy Carbon UD 230GPa Prepare and Epoxy Carbon UD 395GPa Prepare. The outcomes are achieved by comparing them to aluminium alloy. Based on the analysis above, we can conclude that carbon fibres are just a better choice for fabricating a rim, and its life can be extended by improving its surface finish. Although ANSYS is not particularly accurate in trying to analyses stress in composite materials, the results are quite adequate. [3]

S.Arunkumar, this analysis will highlight the best lightweight and high strength material optimization for an automobile wheel rim in 2020. The wheel rim was also subjected to engineering system using the finite element technique. The contour plots obtained for Aluminum alloy 6061, S-Glass epoxy, and E-Glass epoxy materials represent the corresponding stress distribution and total deformation accomplished by an unmodified established automobile wheel rim. The finite element analysis results showed that the S-Glass epoxy resource automobile wheel rim deformed less and generated a greater values and moral principles stress distribution than the Aluminum 6061 wheel rim and the E-Glass epoxy wheel rim [4]

Mr. Chintapalli Shekhar It is crucial to consider cost and protection while constructing such fundamental automobile components so that users can utilize them safely. When designing a new alloy wheel rim, the following five technical factors must be taken into account: styling, aesthetics, mass, manufacturability, and capabilities. Shear stress distribution in vehicle wheels subjected to increased pressure and radial load is examined while stress and displacement are examined. Finite Element Techniques have been discovered after much effort. Utilizing the Catia software, an alloy wheel rim was created. Static analysis was then performed utilizing a variety of materials (Carbon epoxy composite, AL6061, and Mg alloy) under various loads. ANSYS14.5 software considering the load and boundary conditions. Finally, findings of stress, total deformation, and shear stress were observed and compared between different wheel rim materials with hexagonal and elliptical spoke shapes. Thus, the alloy wheel can be manufactured using the optimum design and material. [5]

Kalpesh R.Salunke September 2017 The term "wheel" refers to the major mechanical component of a vehicle's suspension system, which supports both static and dynamic loads. Cars carry huge weights of passengers in addition to their own weight, thus the alloy wheel rim needs to be sturdy enough to support this weight. Therefore, much care should be taken when designing them. In order for a user to utilize such a major vehicle component safely, considerations for cost and protection are crucial. When designing a new alloy wheel rim, the following five technical factors must be taken into account: styling, aesthetics, mass, manufacturability, and capabilities. When examining the distribution of stress and displacement in vehicle wheels under increased Radial load and pressure The Parameter Estimation Techniques have required significant research. Utilizing ANSYS software, static structural study of the alloy wheel rim was performed using a range of objects, loads, and model parameters. In the end, the findings of total deformation and equivalent stresses for various wheel rim materials are produced and evaluated. As a result, the best material may be used to make the wheel rim.[6]

Chaitanya Sureddi November 2018 The goal of lowering unsprung mass can be accomplished by reducing weight, which also improves performance and fuel efficiency by reducing inertia loads and overall weight. By switching out or replacing the materials with composites, it is possible to increase the bearing of stresses while lowering the bulk and volume of an aluminium wheel. To do this, composite materials are used to lighten the components' weight. It is determined from the finite element computations that the mass of the wheel rim from the current alloy wheels can be cut in half. According to the analysis, the stresses created by the rim will be less than the yield stress after optimization. This introduced a novel strategy for passenger automobile wheel rim optimization. We will be using ANSYS15.0 for the analysis with CATIA V5 R20 for the design in this project [7]

Aaron Ressa 2013 Testing was used to create and validate a FEA model, which was then used to analyze and design a laminated carbon fibre composite rim. Several designs were evaluated, and one was chosen for further growth. The final refined design reduced the wheel's weight by nearly 50%. The autoclave is heated to 250°F with a 2°F per minute ramp and then temperature soaked for 2 hours. Because the autoclave lacks a cooling system, the pressure is let go after the heat soak and the part is permitted to cool naturally for approximately two hours until it reaches 150° F. The part is then taken away from the autoclave. [8]

Liangmo Wang to in order to raise the standard of aluminium wheels, this research suggests a novel approach for determining their fatigue life. The static load finite element model of aluminium wheels was created using the ABAQUS programme to simulate the rotary fatigue test. Based on the nominal stress approach, the equivalent stress amplitude was estimated by taking into account the effects of the mean load, size, fatigue notch, surface polish, and scatter variables. The equivalent stress amplitude and aluminium alloy wheel S-N curve were used to forecast the fatigue life of aluminium wheels. The findings of the aluminium wheel rotary fatigue bench test revealed that the baseline wheel failed the test and that the crack's initiation point coincided with the simulation in the hub bolt entire region. The wheel life cycle was increased to over 1.0105 using the technique suggested in this paper, satisfying the design requirement. According to the findings, the suggested method of merging finite element analysis with the nominal stress method was a good and effective way to forecast how long aluminium wheels will last under fatigue.[9]

Yashwanth Kandukuri Sai Wheel rims are important parts that are essential to an automobile's safety. In place of heavy steel rims, conventional wheel rims have been made of monolithic materials such aluminium and magnesium alloys. The current work investigates lightweight composite wheel rims with improved stiffness to lower the weight of the formula car. Although they are more frequently seen in motorsports, composite wheel rims are still in their infancy for use in commercial automobiles. The drawbacks of composite wheel rims include things like difficult fabrication, high cost, and complex design. For more over 13 years, Formula Manipal Racing has produced race cars for Formula India competitions, with aluminium wheel rims as a standard component. After carefully examining various alternative materials, the design and finite element analysis of carbon fibre wheel rims were done in the current work to replace the aluminium wheel rims. also [10]

K. Srinivasa Rao June -2017 Drawing the existing automobile model's wheel rim in Creo 2.0 design software allows for the theoretical calculation and application of various loads and forces, which are then applied to the model and examined using finite element software (17.0) software. The von

Mises stresses, deformations, and shear stresses for the complicated loading that has been applied to the model are first determined by providing the associated engineering data, which includes mechanical properties and their related chemical compositions. Applying forces, such as 90 degree angle pressure (inflation pressure) here on bead sections, side thrust on the rim flange, and tyre pressure on the well area, are all parts of the complicated loading. And the fatigue analysis, which helps determine the product life, damage factor, and safety factors, is evaluated using three different designs of the same car model (the Volkswagen Polo 1.0 TSI), with the rim substances (aluminium, A356-T6, magnesium, MgAm60, titanium, 6Al4V) changed in each case to determine the best design and best material for a specific type of loading. Later, fatigue analysis is also carried out for the same cases to determine which design and material are best. As a result of the incident above, we learned that magnesium has a longer life expectancy and less deformation than aluminium, therefore we created a new material which is an alloy of the two. [11]

IRJET Dhiraj Bhargav 2017 Alloy wheels are ones that are formed of an alloy of aluminium or magnesium and are used in the automotive industry. They differ from steel wheels in that they are significantly lighter, which enhances the car's steering and speed. When compared to steel wheels, alloy rims also have less unsprung weight, this makes the steering more precise and lowers fuel consumption. Multi-Utility Vehicles, or MUVs in this context, are cars that can transport either a lot of passengers or a lot of freight. Developing wheels for such demanding peak load is difficult. The alloy wheels in this case is made of magnesium AZ80 material. This substance was chosen for its excellent mechanical qualities, sturdiness, and light weight. For an 18-inch alloy wheel, a design analysis is conducted, and the design is assessed for cornering test, radial test, and impact test. The distribution of stress is examined further. Setting boundary conditions, importing the model into ABAQUS, employing tetrahedral elements, and doing further linear analysis for radial and cornering tests using ABAQUS/standard solver are all done. The results are then examined. ABAQUS/Explicit is used for additional dynamic analysis of the impact test, and analysis is analyzed in light of the findings. [12]

Conclusion

The research investigation included a few sorts of vehicle spokes, including those for vehicles, cars, spiral wheels, four-wheelers, and motorcycles. The study included a survey on their analysis and design of car rims. Different material properties were mentioned in certain research papers in relation to fatigue conditions. Some study papers addressed the usage of CAD analysis tools including Solid Work, Catia, and ANSYS.

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