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DESIGN AND MANFACTURING OF LOOP WHEEL

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ABSTRACT

A Loop wheel is a wheel with integral suspension, designed for better shock-absorbing performance and greater comfort. Loop wheels give you a smoother ride. They are more comfortable than standard wheels: the carbon springs absorb tiring vibration, as well as bumps and shocks. They're extremely strong and durable. Loop wheel springs are made from a composite material, carefully developed to give optimum compression and lateral stability as well as strength and durability. Specially designed connectors attach the springs to the hub and rim. The three loops in each wheel work together as a self correcting system. This spring system between the hub and the rim of the wheel provides suspension that constantly ad□just to uneven terrain – cushioning the rider from bumps and potholes in the road. In effect, the hub floats within the rim, adjusting constantly as shocks from an uneven road hit the rim of the wheel. The spring configuration allows the torque to be transferred smoothly between the hub and the rim.

KEY WORDS: *Leaf Spring, Loop Wheel, Triangular Hub, ANSYS Workbench*

INTRODUCTION

A wheel is a circular part that's meant to rotate on an axle bearing. The wheel is one of the essential parts of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, enable heavy objects to be moved simply facilitating movement or transportation while supporting a load, or performing labour in machines. Wheels are also used for various alternative functions, such as a ship's wheel, steering wheel, potter's wheel and flywheel. Common examples are found in transport applications. A wheel greatly reduces friction by facilitating motion by rolling along with the use of axles. For the for wheels to rotate, a moment has to be applied to the wheel about its axis, either by means of gravity, or by applying another external force or torsion.

LOOP WHEELS

Loop-wheels fit the vast majority of manual wheelchairs. They make 24″ and 25″ Loop-wheels for wheelchairs. Their wheels 7have 12.7mm bearings to fit standard 12.7 mm quick release axle pins. This is the most common size on most wheelchairs. Some wheel chairs take 12mm axles, and they can make Loop-wheels with this size axle bearing too. When you first put the Loop-wheels on the chair, you just need to check that there aren't any bolts sticking out from the side of your chair that could rub against the wheels. This is not usually the case, but it does happen with some chairs and is not a unique problem to Loop wheels. You should be able to prevent any rubbing by adding some washers to your axle, which will move the wheels out just enough to ensure there is clearance. There are 3 important factors as to whether Loop-wheels are suitable for your bike. 1: Wheel size. 2: Width of the Drop-out centre The "drop out centre" : on a bike is the distance between the forks where the hub fits. 3: Clearance space above the wheel. This is to allow space for the loop□ wheel's suspension to function. As the wheel hits a bump, the wheel moves up towards the frame. You need a minimum of 35mm from the top of the tyre to the underside of the fork (or any other part of the bike frame). If there is less than this 35mm space, your wheel could hit the frame causing it to brake. This is important, If you decide the fit thicker tyres to your Loop-wheels, reduce this clearance gap, If your bike already matches these criteria, you're good to go

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MODEL DIAGRAM

PROBLEM STATEMENT

In the conventional bicycles there no any type of suspension system. The spokes attached to rim has less load bearing capacity for special purpose cycles. The aim of the project is to design new type of wheel with hub, rim and tyre to provide suspension as well as to support rim and provide better bearing capacity.

OBJECTIVE

To design better shock absorbing performance.
To give smoother ride.
To increase load bearing capacity.

SCOPE

In this project we will design and fabricate a loop-wheel bicycle which will be able to have extra feature of shock absorption and also the better load bearing capacity. The project will contain a bicycle with an improved wheel. The wheel will be replaced from conventional rim system to leaf spring or loop spring. The wheel will consist Axle, Hub, Rim, Tyre and Leaf/loop springs. All parts will be mounted in wheel so as to maintain its center of gravity

ADVANTAGES

Better shock-absorbing performance, Greater comfort, Smoother ride, More comfortable than standard wheels, They are extremely strong as compared to other wheel

METHODOLOGY

The started our work with literature survey. Search many research papers from various articles and published journal papers. Worked on different mechanisms that can be useful for our project. The have done a rough 2D sketch of model in Auto-CAD. After get ting rough model started calculation of some components. selected standard components. Simultaneously have done work of report for semester I. Actual preparation of project: the completed calculations of remaining parts. purchased standard components from market. Done a rough 3D model of our project manufacturing will be done. Assembly was completely done. Testing of set up was done. Representation of actual theoretical report was presented.

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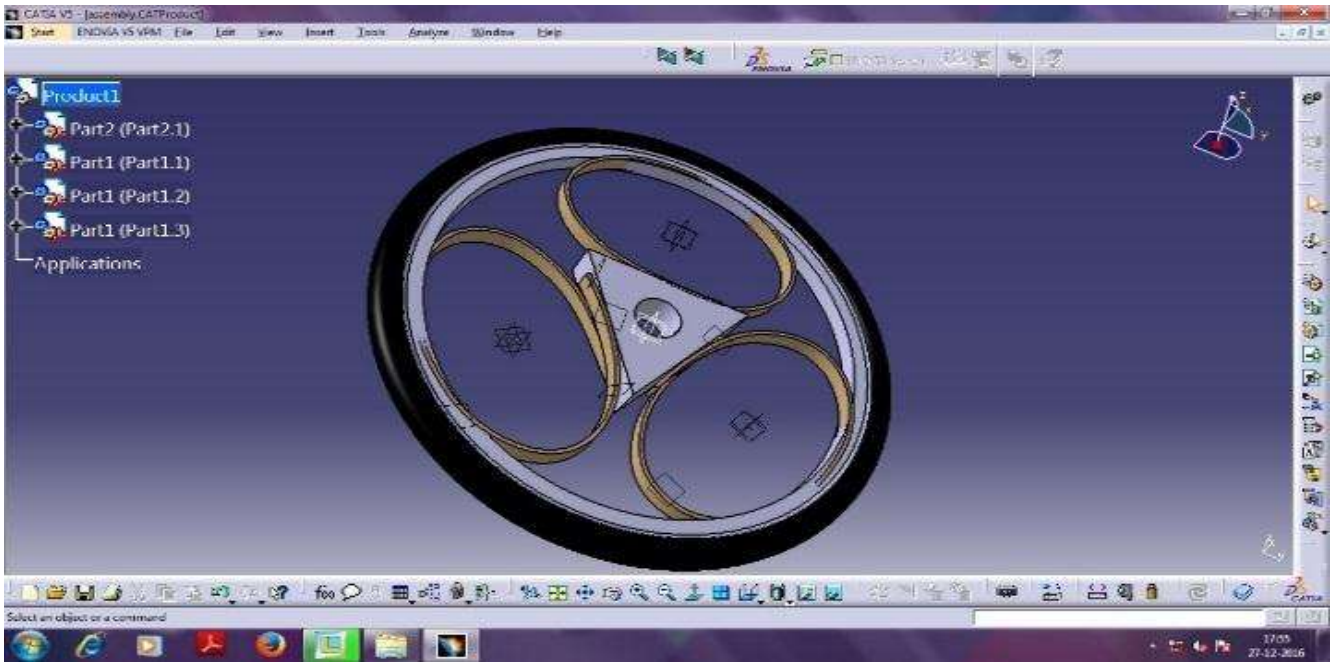
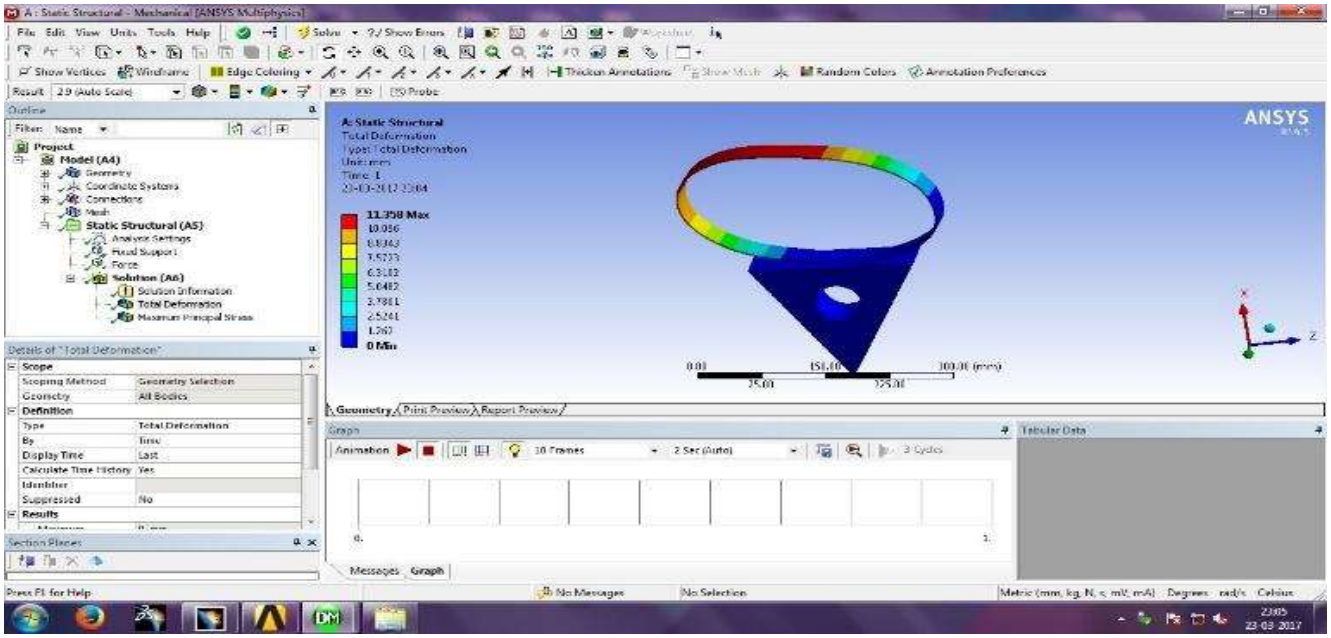
CATIA MODEL



ANSYS RESULT



BASIC DESIGN CALCULATION

Total mass o0f rider =60kg

Total mass of bicycle =10kg

Total mass of system =70kg

Total vertical force =700N

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As this force is acting on both the tires for each wheel the value of force =350N
Now this is maximum Value of force against which we have to design Loop wheels

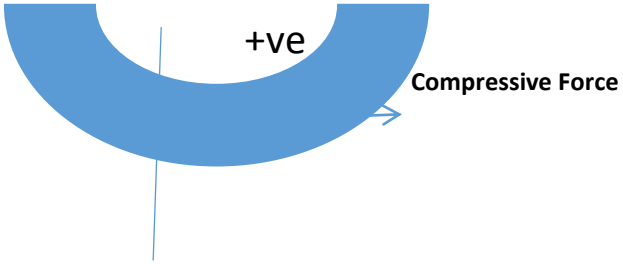
Loop Design

Here we are selecting mild steel material for loop, with 5mm thickness so we have to design the system against bending stresses by considering the positive bending.
By using flexural formula for pure bending .

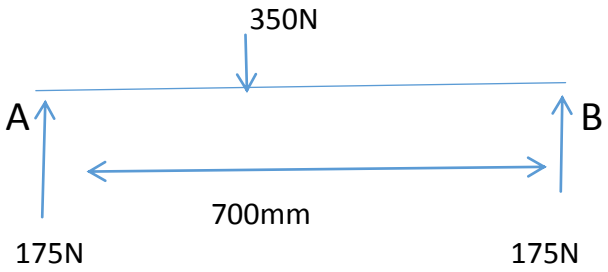
$$M/I=\varepsilon/R=\sigma/Y$$

M=Maximum moment valve
Moment of inertia
ε=Modulus of elasticity
R=Radius of curvature
σ=Stress induced
Y=Position Of netural Axis

1. **Positive Bending**



2.



3. Maximum Bending

M = BM= W/2*L/2= 175* 175= 30.625N-m
Maximum bending occur at the centre. In our case this is the point where outer wheel is connected on the loop.

As we know the cross section value mild steel material strip, we are using for loop.
b=50mm
d=5mm

Moment of inertia	= bd^3/12	=50*5^3/12	= 520.83mm^4
Position of neutral axis	=d/2	=2.5mm	
Maximum value moment		=30.625N-m	
Stress Induced	=M*Y/I	=30.625*2.5/520.83	=147N/mm2

:As the Sut of Mild Steel is lies between 420 to 460 N/mm2 our design is safe.

4] Maximum Deflection

GIVEN: l=300 major axis of loop spring

Max = 3FL^3/8Enbt^3
=3*370*300^3/8*210*10^3*1*50*5^3
=2.85mm

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This is the maximum value of deflection occur when person site on bicycle.

Conclusion

Bicycle with loop wheel suspension system provides smoother ride, high shock absorption capacity, avoids the necessity of additional suspension system. Also this loop wheels can find their applications in wheel chairs, mountain bikes because of their capacity to adjust to uneven terrain, cushioning the rider from abnormalities in the road. Analysis on deformation has been done which shows that the calculated and the values obtained using ANSYS are in accordance with each other which suggests that the design is safe.

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