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DESIGN AND ANALYSIS OF 360° WHEEL ROTATING CHASSIS USING CREO PARAMETRIC 3D MODELING

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Abstract: The normal wheel vehicles face more problems like parking, U turn and much more which consumes more time. These problems can be avoided using 360^0 degree wheel rotating chassis. The initial dimensions and weight for the vehicle is considered from the internet as a reference. The main objective of this paper is to model and perform static analysis on the chassis of a four-seater car. The initial design for the chassis was a space frame body which is very rigid and had very less deflection. The second and final chassis is a ladder type chassis which is most common chassis type being used in India. The difference in deflection between both the chassis type is very less, which is about 0.3235 mm for a reasonable reduction in weight which is about 120 Kg. The simulation part is carried out in ANSYS software. The result is selection of best suitable material for chassis on the basis of ANSYS and theoretically calculated result.

Index Terms **- Chassis modelling, Structural Analysis, and ANSYS**

I. INTRODUCTION

This vehicle moves in all directions and this design provides better comfort and also saves the time, most of the people uses this vehicle to carry goods, emergency patients etc. A 360 angle is called complete angle, a full angle, a full turn. It forms a circle around a point and rotate about its center. This project is about design of 360 degree wheel rotating vehicle chassis, this vehicle chassis moves in all directions and this design provides better comfort and also saves the time of customers. Most of the people using this vehicle to carry goods, patient etc. But most of the time, they have to face the problem like taking U turn, so the 360 degree chassis helps out in solving the problem of U turn. This project is about design of 360 degree wheel rotating vehicle [1].

This vehicle moves in all directions and this design provides better comfort and also saves the time of customers, most of the people using this vehicle to carry goods, patient etc. But most of the time, they have to face the problem like taking U turn etc. So have to design a 360 degree wheel rotating vehicle to reduce and eliminate problems in the industry and at the railway platform. Zero degree turning radius of a vehicle implies the vehicle rotating about an axis passing through the center of gravity of vehicle i.e. the vehicle turning at the same place, where it is standing. No extra space is required to turn the vehicle. So vehicle is to be turned in the space equal to the length of the vehicle itself. So as a result this arrangement of the vehicle wheels to turn 90 degrees left and 90 degree right from original position, but front wheels of this vehicle rotate 360 degree by steering, sprocket and chain drive arrangement. Without moving from the spot, i.e. the vehicle has zero turning radius [2].

This helps in maneuvering the vehicle in tight spaces such as parking lots and within small compounds. The various functions of the steering wheel are to control the angular motion the wheels, direction of motion of the vehicle, to provide directional stability of the vehicle while going straight ahead, to facilitate straight ahead condition of the vehicle after completing a turn, the road irregularities must be damped to the maximum possible extent. This should co-exist with the road feel for the driver so that he can feel the road condition withoutexperiencing the effects of moving over it [3-4]. Fig.1 gives the detailed 3-d cad model of 360^0 wheel rotating chassis.

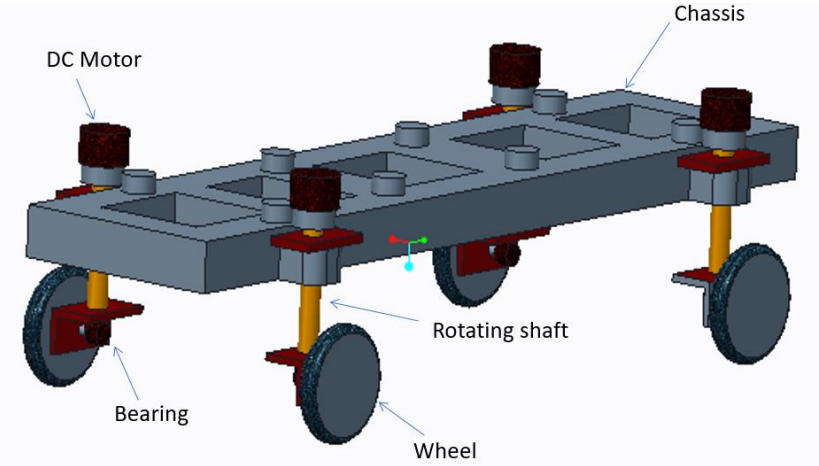

Fig.1 3-d cad model of vehicle

II. Design of Chassis

In order to design a chassis its parameters are to be known and the material that are to be used for different materials needed to be known the material properties are taken form ASTM International (American Society for Testing and materials).

The dimensions of a chassis are taken as per the given chassis that is used in order to take the readings. The dimensions are 1332*5462 i.e. (l*b). The design is carried out in creo parametric and material properties are defined as per the requirements [7]. Fig.2 and Fig.3 shows the 3-d cad creo model of the chassis.

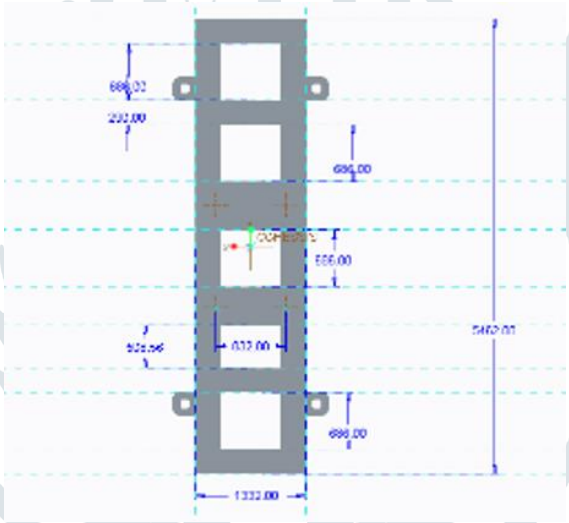

Fig.2 3-d cad creo model of the chassis

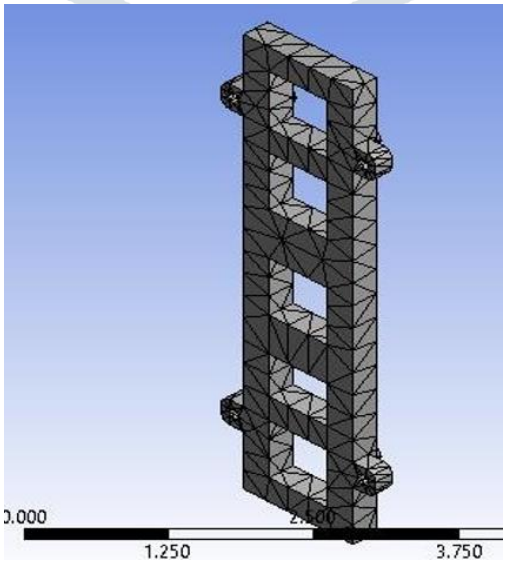

Fig.3 3-d cad model of chassis

III. ANALYSIS OF CHASSIS

Detail study on stress Ansys on the chassis and creating adefined analysis using finite element method and static structural for analysis

The static analysis a typical ladder type chassis is considered Vehicles with a ladder type frame are easier to assemble. It is tough and great for carrying heavy loads for an extended period. It is used as a mounting point for the body, suspension and other components. It is easy to design, build and can be used in multiple applications with minimal modification. The different load considerations are taken for analysis. Varying materials and cross section of beam design the chassis analytically.

In order to perform the analysis, the following material properties is considered for the design of the chassis. Table 1 provides the details of the material considered for the analysis of the chassis.

Table 1 The details of the material considered for the design of the chassis.

Sl NO	Property	Value	Unit
01	Density	7850	kg/m3
02	Tensile yield strength	$2.5E^{08}$	Pa
03	Tensile compressive strength	$2.5E^{08}$	Pa
04	Tensile ultimate strength	$4.6E^{08}$	Pa
05	Compressive ultimate strength	0	Pa
06	Volume	1.5145	m3
07	Mass	11889	kg

Steel has strong strength, low weight, durability, ductility, and corrosion resistance as physical qualities. Steel, despite its small weight, has a lot of strength. Steel, in fact, has the lowest strength-to-weight ratio of any building material.

1) Simulation on stress analysis when 500N load is applied on chassis

The simulation would provide a detailed stress distribution map of chassis under steady-state conditions. This would include the stress distribution of chassis. The maximum stress is 53818pa and minimum stress is 7.506pa. If the maximum stress on a chassis is 53818pa and the minimum stress is 7.506pa, it indicates a stress difference of 53810.494pa across the chassis.

It is important to note that high stress can have negative impacts on the performance and lifespan of chassis. For example, high temperatures can lead to increased cell degradation, reduced efficiency, and shortened lifespan of the chassis. Therefore, it is important to design chassis with appropriate materials. Fig. 4 shows stress analysis when 500N load is applied on chassis.

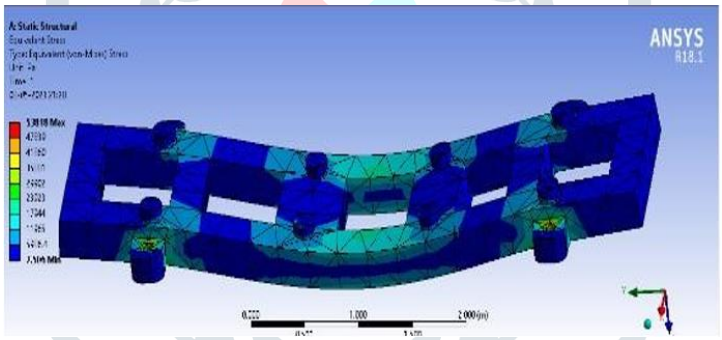

Fig. 4 stress analysis when 500N load is applied on chassis.

2) Simulation on deformation analysis when 500N load is applied on chassis

The simulation would provide a detailed deformation distribution map of chassis under steady-state conditions. This would include the stress distribution of chassis

The maximum deformation is 6.2643e-7mm and minimum stress is 0mm If the maximum stress on a chassis is 6.2643e-7mm and the minimum stress is 0mm, it indicates a stress difference of 6.2643e-7mm across the chassis. Fig.5 gives the deformation analysis when 500N load is applied on chassis.

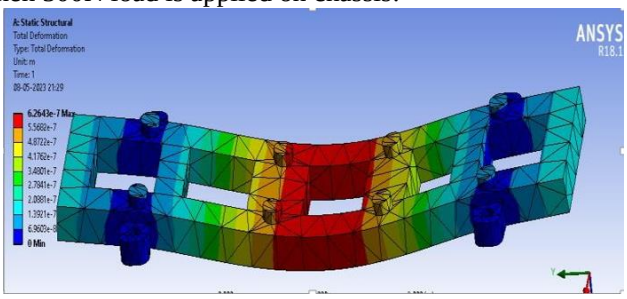

Fig.5 Deformation analysis when 500N load is applied on chassis

3) Simulation on stress analysis when 313.92N load is applied on chassis by motor

The maximum stress is 7691pa and minimum stress is 4.349pa. If the maximum stress on a chassis is 7691mpa and the minimum stress is 4.349mpa, it indicates a stress difference of 7486.66mpa across the chassis. Fig. 6 provides the stress analysis when 313.92 N load is applied on chassis.

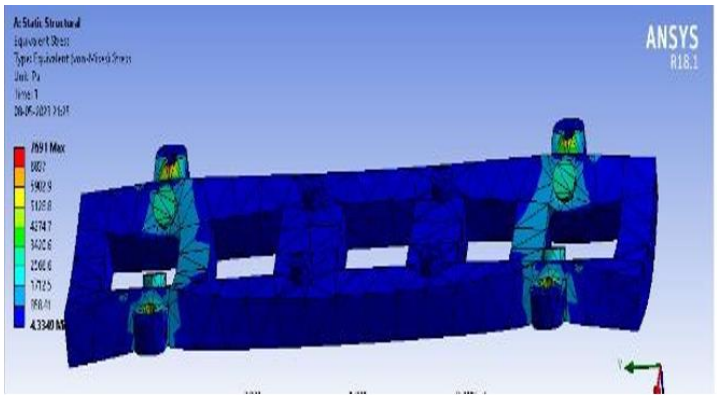

Fig. 6 stress analysis when 313.92 N load is applied on chassis.

4) Simulation on defomation analysis when 313.92N load is applied on chassis

The maximum deformation is 1.2757e-8mm and minimum stress is 0mm If the maximum stress on a chassis is 1.2757e-8mm and the minimum stress is 0mm, it indicates a stress difference of 1.2757e-8mm across the chassis. Fig. 7 represents the deformation analysis when 313.92N load is applied on chassis.

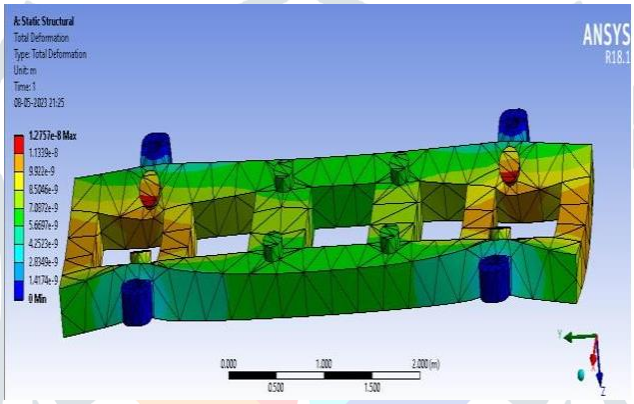

Fig. 7 Deformation analysis when 313.92N load is applied on chassis

IV. CONCLUSION

This work focuses on modelling and analysis of ladder frame chassis of a vehicle. A model for the proposed approach was created by acquainting controlling and DC engine with wheel turn 360 degree. It will be helpful in many industries. Also, Vehicle will be able to rotate in tight spaces easily & parallel parking & U-turn problem will be solved. The maximumstress when 500N load was applied was 53818pa and when 313.92N load was applied 7691pa bythis we can apply 500N load on structural steel material.

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