Analysis of a Bicar Chassis

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Abstract: As bike is cheapest as compared to the car, and that's why it uses most for daily work, but it also has some limitation such as, it's hard to travel long distance and to ride in the rainy season, because the bike is not giving that much comfort which a car can give. To remove these limitations we need something which can provide the comfort of a car as well as the mileage of bike. That's why it's time to move towards a 'BICAR.'
Bicar is a combination of bike and car. It gives the comfort of a car with a high mileage of bike. Bicar is a small car which needs less space to park, light in weight and it is very useful in all kind of weathers such as rainy, summer and winter. As we know a disabled person is unable to drive the bike as well as car, this type of vehicle can also be useful for the handicapped person with a small change.

I. INTRODUCTION

After the invention of Bike, Car, and Heavy vehicles, the transportation becomes very easy. Before these inventions, it's hard to travel from one place to another location and also requires tremendous time. Thus the vehicle mentioned above reduces the efforts up to a large extent and it will also lessen the pollution up to a large extent. But these vehicles also have some limitations and to remove that bicar is needed. Bicar is a combination of bike and car. It gives the comfort of a car with a high mileage of bike. Bicar is a small car which needs less space to park; light in weight and it is very useful in all kind of weathers such as rainy, summer and winter.

II. METHODOLOGY

1. The design of chassis.
2. Model in CAD.
3. Selection of Material for Chassis
4. Selection of Welding for Chassis
5. Selection of engine.
6. Design a Balancing Mechanism.
7. Analyze Chassis for different loads.

The chassis can be called as the skeleton of a vehicle besides its purpose being seating the driver, providing safety and incorporating other subsystems of the vehicle.

After the study, I decided to use tubular space frame chassis which is used for the public car. Since ladder chassis is not strong enough, motor racing engineers have developed a 3-dimensional design which known as tubular space frame.
Tubular space frame chassis employs dozens of circular-section tubes (some may use square section tubes for easier connection to the body panels though circular section provides the maximum strength), position in different directions to provide mechanical strength against forces from anywhere. These tubes are welded together and form acomplex structure. For higher strength required by high-performance sports cars, tubular space frame chassis

Usually incorporate a stable structure under both doors. Tubular space frame chassis also unyielding in any direction compared with ladder chassis and monocoque chassis of the same weight.

A. Cad Model

I design the primary model of chassis in 'CATIA' in which an engine is located at back side of driver's seat, and balancing mechanism is between seat and engine. The following figure shows the overview of chassis.

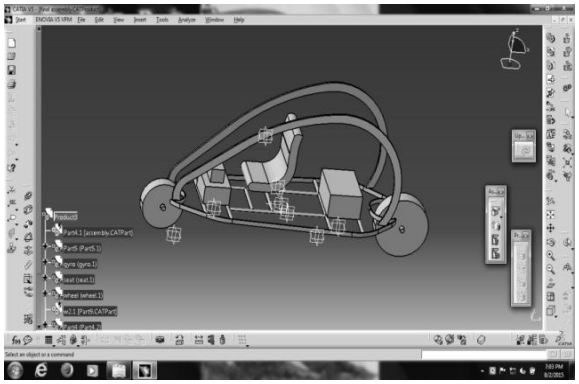

Figure 1: Primary Design on Catia

B. Selection of Material for Chassis

Thus after analyzing the number of materials I selected Cold Rolled Carbon Steel (CRC). It offers a range of good mechanical properties like high strength, good toughness, good surface finishing, good workability, excellent weld ability and widely available.

C. Welding for Chassis

For Welding, the pipes of CRC to build chassis 'MIG' welding is selected. CRC material is easily get welded by this type of welding, and it is cheapest and easily available.

Figure 3: Co_2 Welding to Weld Chassis

D. Specifications of Bicar

The BI-CAR has following Specifications.

1. Ground clearance 1 feet (304.8mm)
2. Overall length is 7 feet.
3. Width is 850 mm
4. Height is 1850 mm from chasse's lower end.
5. The radii of a wheel are 1 feet.
6. Engine type- Four Stroke 150cc (Bajaj Pulser).
7. Fuel – Petrol.
8. Mechanism- automatic balancing without the gyroscope.
9. Numbers of Wheels- 6 Wheels
10. Number Of seats- Two
11. Weight of Bi-Car- 212 kg
12. Cooling System- Air Cooling System
13. Mileage of Bi-Car- 35 - 40km/lit.

E. Balancing Mechanism

Main aim is to balance the bi-car, for that purpose, there are following options:-

- Gyroscope mechanism.
- Hydraulic cylinder operated on a motor with the help of sensors.
- Geared Motor with Scissor jack.

a) Gyroscope mechanism

It is a device work on the principal of active and reactive couple. With the help of active and reactive couple, dynamic stabilization of the vehicle is possible.

b) Hydraulic cylinder operated on a motor with the aid of sensors.

This mechanism is operated by the hydraulic cylinder in which cylinders are work with the help of hydraulic motor and motor is managed by using sensors.

c) Geared Motor with Scissor Jack

For balancing mechanism geared motor is used with a scissor jack. Geared motor can easily operate by DC power source with 12 volts, 9-ampere current. And the capacity to lift the load is 2 tons. As the speed goes above the absolute limit (30 km/hr.), by using, remote secondary wheels can be lifted, and the vehicle will run on two wheels. The remote can also be replaced by sensors in which sensor sense the speed and operate the motor to lift the wheels. And as the speed came down, wheels come downward and then the vehicle will run on six wheels, thus completely balanced

Figure 4: Geared Motor with Scissor Jack

Figure 5: Secondary Wheels for Balancing

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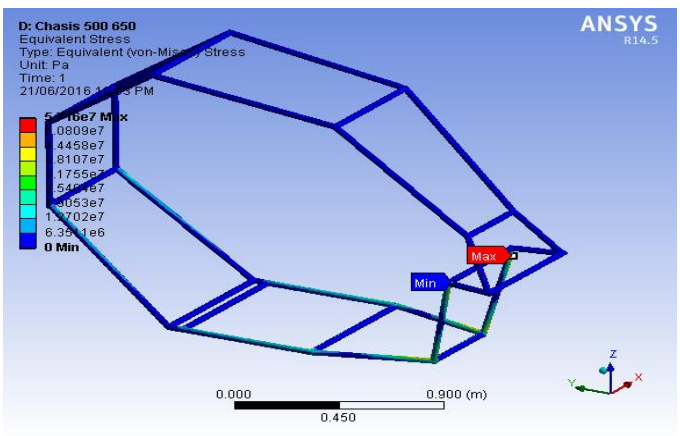
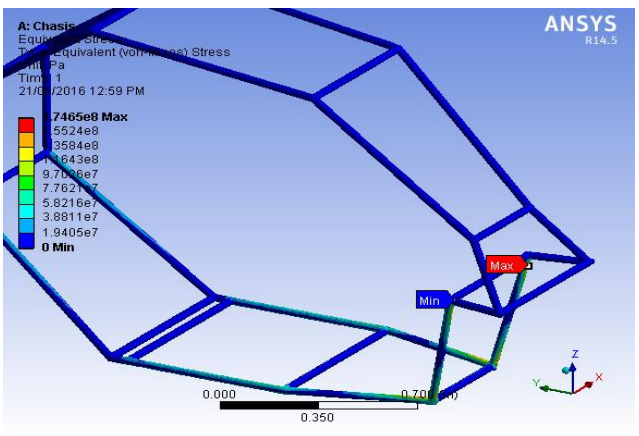
Figure 6: Side view of Bicar

III. RESULTS

As chassis is most important part in the body, so it should not fail at any load which comes on it. Thus chassis's analysis is necessary to check whether it is safe or not. To check its structure analysis is needed by using 1G and 3G load. 1G load is the load which comes on chassis at rest condition.

It's difficult to calculate the exact load which comes on the vehicle during its motion; that's why the analysis is performed by using 3G load. 3G load three times of static load.Fig.Shows the stress distribution at 1G and 3G load. The stress induced in the chasse due to 1G and 3G load is 54.1 MPa and 174.6 MPa respectively, which is less than the tensile strength of material. Fig. Shows the deformation of chasse due to 1G and 3G loads is 1.4 mm and 4.3 mm respectively. As the deformation is so small, thus it is negligible.





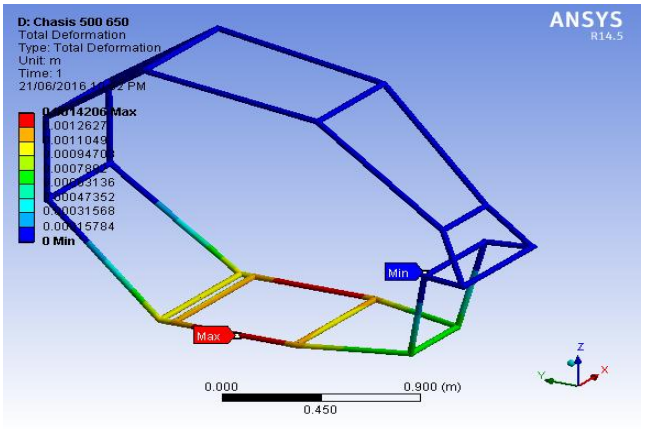


Fig.4.1:-Stress Distribution at 1G Load 2300N (57.1 MPa)

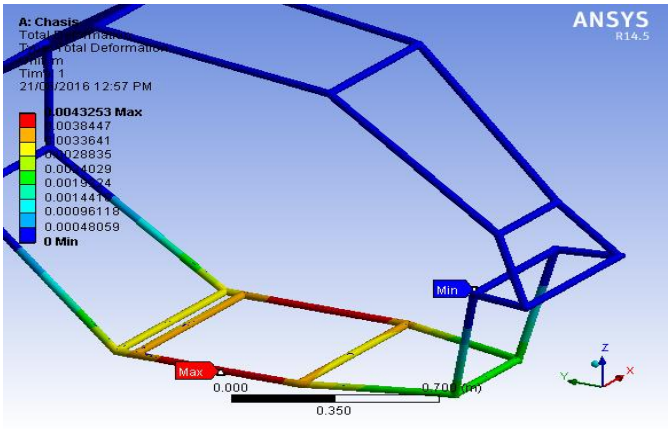


Fig.4.2:-Stress Distribution at 3G Load 7000N (174.6 MPa)

Fig.4.3:-Deformation at 1G Load 2300N (1.4mm)

Fig.4.4:-Deformation at 3G Load 7000N (4.3mm)

CONCLUSION

In this chapter the main findings of the dissertation are summarized,

1. In this project, Bicar's chassis is modeled by using 3D parametric software Catia V5.21.
2. Design is checked by analytical stress calculations as well as finite element analysis method.
3. The induced stresses in components were less than allowable stresses, hence design is safe.
The stress induced in the chasse due to 2300 N and 7000 N load is 54.1 MPa and 174.6 MPa respectively, which is less than the tensile strength of material.
The deformation of chasse due to 2300 N and 7000 N load is 1.4 mm and 4.3 mm respectively. As the deformation is so small, thus it is negligible.
4. The Bicar has been successfully fabricated in the workshop. Further it has been tested for proper functioning by using road tests.
5. The concepts of Bicar have proven to be effective over the bike. Also the balancing System seems to be operating very reliably.
Upon completion of project this dissertation work will serve as a guide for the engineers who are working in the same domain.

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