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Design and Analysis of Two Wheeler Composite Chassis Frame A Review

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ABSTRACT

The chassis frame forms the backbone of a vehicle. Automotive chassis is the main carriage system of a vehicle. The two-wheeler chassis consists of a frame, suspension, wheels and brakes. Commonly used material for two-wheeler chassis is steel. Steel material makes the chassis frame heavy and thereby increasing overall weight of vehicle. Weight reduction is the crucial issue in today's automotive industries since it greatly affects the fuel efficiency of vehicle. Composite materials providing outstanding solution to this problem. In this paper an effort is made to review the investigations that have been made in design and analysis of various automotive parts with application of composites material.

Keywords : Chassis Frame, Two Wheeler, Composite Materials, Weight Reduction.

I. INTRODUCTION

A vehicle without body is called chassis. A chassis is nothing but an internal framework that supports a man-made object. It is analogous to an animal's skeleton. The chassis serves as a frame work for supporting the body and different parts of the automobile like engine, transmission, driveshaft, differential, and suspension. A body, which is usually not necessary for integrity of the structure, is built on the chassis to complete the vehicle. The automotive chassis is tasked with holding all the components together while driving and transferring vertical and lateral loads, caused by accelerations, on the chassis through the suspension and the wheels. Therefore the chassis is considered as the most important element of the vehicle as it holds all the parts and components together. It is usually made of a steel frame, which holds the body and motor of an automotive vehicle. The frame also serves as a support for the suspension system, a collection of springs and shock absorbers that helps keep the wheels in contact with the road and cushions the rider from bumps and jolts. Here in this paper we mainly discussed about the two wheeler chassis frame only.

II. METHODS AND MATERIAL

The different types of two wheeler chassis frame include:

A. Backbone Frame

The backbone frame comprises a single, wide main beam from which the engine is suspended. The backbone frame allows for great flexibility in design, since it is concealed inside the finished motorcycle. The engine just seems to hang in midair. It is simple and cheap to make, and is used mainly on naked and off-road motorcycles ex-Hero Honda CD 100.

B. Diamond Frame

It is one of the most common type of frame found on Indian bikes. The diamond frame gets its name from the frame on a bicycle, where the shape that the frame makes is that of a diamond. Examples of bike with such frame are Bajaj Pulsar 135 LS, Hero CBZ Xtreme, Yamaha Fazer, TVS Flame, etc.

C. Single Cradle Frame

The single cradle is the simplest type of motorcycle frame, and looks similar to the first ever motorcycle frames. It is made from steel tubes that surround the engine with a main tube above and other, smaller diameter tubes beneath. If a single cradle becomes double at the exhaust, as frequently occurs, it is referred to as a split single cradle frame. Single cradle frames are usually found in off-road motorcycles ex- Bajaj Platina, Bajaj Discover 100,Honda bikes etc.

D. Double Cradle Frame

Double cradle frames are descended from single cradle frames. They consist of two cradles that support the engine one either side. Double cradle frames are commonly used in custom motorcycles and simpler road bikes. They offer a good compromise between rigidity, strength and lightness, though they have now been technically surpassed by perimeter frames. Ex- TVS Apache RTR 180, Bajaj Pulsar 180 DTS-i, Passion and all Hero motocorps bikes etc.

E. Perimeter Frame

Motorcycle racing research has shown that major advantages are to be gained in terms of rigidity by joining the steering head to the swing arm in as short a distance as possible. This is the concept behind the perimeter frame. Two robust beams descend in the most direct way possible from the steering head to the swing arm, passing around the engine. The earliest perimeter frames were made from steel, but the need to improve rigidity to weight ratios led most manufacturers to adopt aluminum instead. The only two bikes with perimeter frame currently in India are the Bajaj Pulsar 200NS and the Yamaha R15.

Weight reduction of bike is now important issue in automobile industries in order to provide good balancing and improved fuel efficiency. Total weight of any bike is approximately 100-150 kg. As weight of chassis is near about 10-15% of total weight of bike, considerable weight reduction can be achieved by reducing weight of chassis. Also, while reducing the weight of chassis design should be such that it will give strength and stability to vehicle under different loading conditions (static and dynamic loading conditions).

Weight of such frames can be reduced either by changing the material or by changing dimensions of chassis. This project is mainly subjected to the weight reduction by changing existing material with composite material and its analysis. This paper contains review of research work that has been done up till now in design and analysis of various composite automotive parts. Paper starts from the overview of composite materials and mainly focuses on the comparative analysis of conventional material and composite material for automobile parts especially vehicle chassis frame. Efforts made through this literature survey provide necessary inputs and the direction to the design and analysis of two wheeler composite chassis frame.

F. Overview on Composite Materials and their applications

Composite materials [1] have been using for thousands of years, e.g. they have manufactured bricks with the help of mud which is thousand-year-old technology. Now days, we all depend on composite materials at some aspects of our lives. Composite material defined as a mixture of two or more than two materials (reinforcement, fillers and binder) different in composition. Composite materials also called composition materials or shortened to composites. Composite materials are materials made from two or more than two materials with considerably differ in physical and chemical properties, that when combined, make a material with appearances different from the individual components. Composites comprise strong load carrying material is known as reinforcement and weaker materials is known as matrix. Reinforcement provides stiffness and strength which helps to support structural load. Composite materials do not lose their respective identities but still relate their properties to the product causing from their mixture. The benefits of composite materials have their great stiffness and strength. There are in many cases, the reinforcement is stronger, tougher, harder and stiffer than the matrix. It finds application in automotive, aerospace, electronic equipment, sport goods, furniture, medical equipment & packaging Industry. Composite materials used as an industrial material for their outstanding resistance to chemicals and most forms of corrosion. This property of composite material conventionally important is hardly the only useful property. There are many important and useful properties are, low mass, low weight unequalled manufacturing and processing possibilities, complex material body are easily produced, appropriate to very small products and very large product, tooling cost is very low, satisfactory surface finish can be an integral feature. Composites have four to six times tensile strength as compare to steel or aluminum (depending on the reinforcements). Composites have less noise and lower vibration transmission than metals at the time of operations. Composite materials have tensional stiffness and impact properties. Composites have high fatigue strength, impact, environmental resistance and reduce maintenance, higher fatigue endurance limit (up to 60% of ultimate tensile strength. Composites exhibit fire retardancy and good corrosion resistance. Composites have improved surfaces properties and readily incorporable integral decorative melamine is other characteristics of composites, low electrical conductivity and thermal expansion. Composite parts can eliminate joints and providing simplification and assembly design compared to non composite metallic parts. Composite materials have high cost of material, long development time, manufacturing difficulties, low ductility, temperature limits, solvent or moister attack, hidden damages and damage susceptibility. Matrix used in composite materials is subject to environmental degradation and analysis is difficult, hot curing is necessary in many cases requiring special tooling, hot or cold curing takes time. Materials require refrigerated transport and storage and have limited shelf life.

G. Application of Composite Material.

1. In Aerospace- Approximately 50% component of the airspace is made from composites. The primary benefits that composite components are reduced weight and assembly simplification. The large scale use of composites in current program of development of helicopters, military fighter aircraft, small and big civil transport aircraft, satellites, launch vehicles and missiles. Various components of aircraft are fabricated by composites, e.g. rudder, spoilers, airbrakes, elevators, LG doors, engine cowlings, keel beam, rear bulkhead, wing ribs, main wings, turbine engine fan blades, propellers, Interior components etc.

2. In Automotive - Composites are being considered to make low weight, safer and more fuel-efficient vehicles. A composite is composed of a high strength fiber (carbon or glass) in a matrix material (epoxy polymer) that when combined provides magnify properties compared with the individual materials by themselves. Many components like chassis[2], steering wheel, dashboard, seat, roof, hatch, mats, energy absorber, instrument cluster, interior and exterior panel, leaf spring[7], wheels, engine cover etc. fabricated by composite materials.

3. In Medical- A composite is a nonviable material used in a medical device and intended to interact with biological system. Over the centuries, advancement in synthetic materials, surgical technique and sterilization methods have permitted the use of composite material in many ways. Medical practice today utilizes a large number of devices and implants. Composites in the form of sutures, bone and joint replacements, vascular grafts, heart valves, intraocular lenses, dental implants, pacemakers, biosensors, artificial hearts etc. widely used to replace and/or restore the function of disturbed or degenerated tissues or organs, to improve function, to assist in healing, to correct abnormalities and thus improve the quality of life of the patients.

4. In Electrical field- Composite materials have strength, high modulus; electronic composites emphasize high thermal conductivity, low thermal expansion, low dielectric constant and high/low electrical conductivity depending on the particular electronic applications. Electronics composites can use expensive fillers, such as silver particles, which serve to provide high electrical conductivity. The application of composites in electronics include interconnections, printed circuit boards, interlayer dielectrics, die attach, lids, thermal interface materials, electrical contacts, connectors, heat sinks, housings etc.

5. In Sports- Composite materials are used in sports equipment because they offer ease of transport, resistance, low weight, low maintenance and durability. Initially, natural materials, like wood, were used due to its good shock absorption, but these materials had some drawbacks. The anisotropic nature resulted in low resistance and the variation in properties and high moisture absorption allocate various deformations. The composite material has characteristics of fatigue resistance break resistance, superior thermo stability, friction resistance, abrasion resistance and vibration attenuation, and it has light weight, high strength and high design freedom, and can be processed and shaped easily, so it is widely used in sports equipment. There are various goods made of composite materials, including the planning boats, sailing boats, sailboards tennis rackets, badminton rackets, softball bats, ice hockey sticks, bows and arrows etc.

6. In Chemical Industry- Advantages of composites of fire resistance properties, lightweight, mold ability, and resistance to chemicals has made the material used in the chemical industry. Composites are extensively used in industrial gratings, scrubbers, ducting, piping, exhaust stacks, pumps & blowers, structural supports, storage tanks, columns, reactors etc. for alkaline & acidic environments. Some applications are drive shaft, fan blades, ducts, stacks, underground storage tanks, casings, composite vessels etc. Internationally, composites applications in chemical industry are a relatively small segment in relation to the total usage of composites .

7. Other- Composites have long been used in the construction for industrial supports, buildings, long span roof structures, tanks, bridge components and complete bridge systems. With composites exhibiting excellent resistance to the marine environment. With the help of composite we make light weight doors, window, furniture, building, bridge etc. for domestic and construction purpose.

Recently, the use of composite materials has increased rapidly in automotive domains. As reported, according to [1], it is remarked that the total global consumption of lightweight materials used in transportation equipment will increase at a compound annual growth rate (CAGR) of 9.9% in tonnage terms and 5.7% in value terms between 2006 and 2011 (from42.8 million tons/US$80.5 billion in 2006 to 68.5 million tons/US$106.4 billion in 2011) [1]. In automobile domains, the use of composites mainly consists of chassis parts, bumpers, drive shafts, brake discs, springs, fuel tanks, and so on. Composites have many advantages over traditional materials, such as their relatively high strength and low weight, excellent corrosion resistance, thermal properties and dimensional stability and more resistance to impact, fatigue and other static and dynamic loads that vehicle structures could be subjected. These advantages increase the performance of vehicles and lead to safer and lower energy consumption. It should be noticed that vehicle performance is affected not only by the engine horsepower, but also by other important parameters such as the weight/horsepower ratio and the good distribution of the weight.

New developments in composites are continually taking place with a wide range of polymeric, metallic and ceramic material being used both as fibers and matrix materials. Research and development activities in this area are concerned with improving strength toughness, stiffness, resistance to high temperature and reliability in service.

H. Review on design and analysis of various composite automobile parts

After having comprehensive discussion over composite materials and their applications, with reference to my project work, let us take the review on design and analysis of various composite automobile parts. This review mainly confined to heavy duty vehicles, light duty vehicles and two wheelers.

1. Heavy Duty Vehicle Composite Chassis Frame

Composite material like carbon fiber and E-glass Epoxy fiber recently gained a wide acceptance in the automobile industry due to their light weight and high strength as compare to conventional automobile frame which is manufactured from steel and its alloy. Increasing demand of highly efficient and less weight automobile's have made the researcher to do brain storming to search new materials and composite materials gained wide attention to be introduced in auto vehicle due to their less dense and high strength and stiff in nature.

Manoj Jaya Prakash Swain Prof. Amit Kumar[2] explored chassis frame with composite material to attain socio-economic benefits. In this paper Author highlighted that the composite materials are proving themselves as promising material in replacing automotive components for better mechanical properties. In this it is emphasized that the Chassis frame is base for all automotive components and absorb all running forces and impact forces thus needs to be strong enough. The work started with development of product design specification sheet and simultaneously material selection was carried out through

detailed study. Solid model of Space frame tubular chassis selected for exploration was developed in CATIA and force calculations were done, analysis were done using ANSYS software. Author concluded that E-glass/epoxy, HS-carbon/Epoxy and HM-carbon epoxy are best suitable composite material which can be further analysed for stresses and deformation. The results revealed the possibility of Chassis Frame with composite material. HS-Carbon/Epoxy and HM Carbon/ Epoxy shows 79% weight saving while E-glass/Epoxy shows 74% weight saving against existing material and stresses are found in within material capability.

K. Venkatarao and J. Chandra Sekhar [3] have designed and analyzed the **TATA 1109 EX2 vehicle chassis frame.**In this paper the analysis is done with two different composite materials namely E-glass/Epoxy and S-glass/Epoxy subjected to the same pressure as that of a steel frame. The results are then compared with existing steel material as tabulated in below table

Material	Mass(Kg)	Maximum normal stress (MPa)	Maximum equivalent stress (MPa)	Maximum deformation (mm)
Structural Steel	385	3359	17686	5.68
E-Glass/Epoxy	128	2888	17055	9.45
S-Glass/Epoxy	79	2312	16769	4.03

Author finally concluded that by employing a polymeric composite heavy vehicle chassis for the same load carrying capacity, there is a reduction in weight of 70% to 80%**.** Based on the results it is inferred that S-glass/Epoxy polymeric composite heavy vehicle chassis has superior strength, less deformation, less normal stress and less weight compared to steel, E-glass/Epoxy. From this work it is understood that that it is better to use S-glass/ Epoxy as a material for frames of heavy vehicle chassis. So that the fuel consumption decreases for the vehicles.

M. Ravi Chandra, S. Sreenivasulu, Syed Altaf Hussain[4] have also designed and analyzed the vehicle chassis of a TATA 2515EX vehicle. In this work three different composite heavy vehicle chassis have been modeled by considering three different cross-sections namely C, I and Box type cross sections. For validation the design is done by applying the vertical loads acting on the horizontal different cross sections. Software is used in this work PRO – E 5.0 for modeling, ANSYS 12.0 for analysis.Results are graphically shown as below for different sections

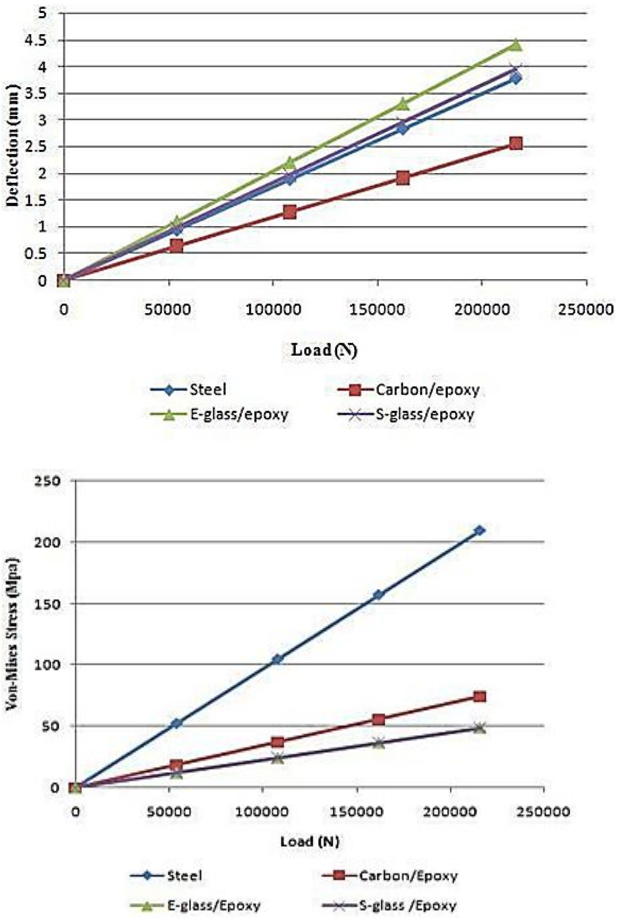


Figure 1. C-Section

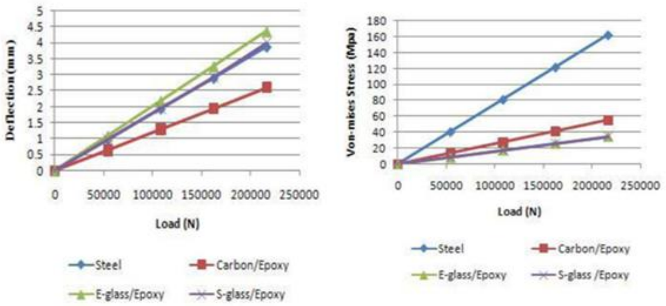


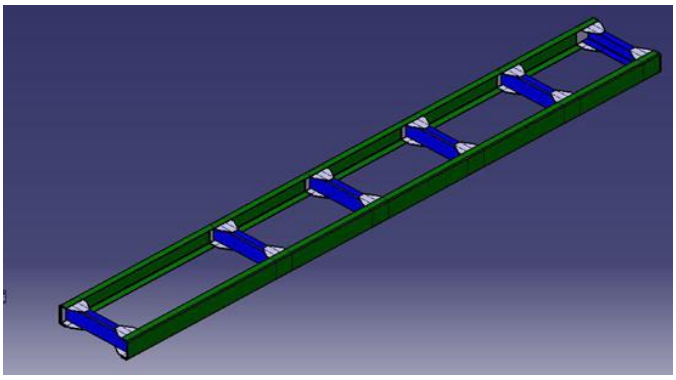
Figure 2. I Section

With observing the all results and comparing the polymeric composite heavy vehicle chassis and steel heavy vehicle chassis with respect to weight, stiffness and strength polymeric composite heavy vehicle chassis is lighter and more economical than the conventional steel chassis with similar design specifications. By employing a polymeric composite heavy vehicle chassis for the same load carrying capacity, there is a reduction in weight of 73%~80%**,** natural frequency of polymeric composite heavy vehicle chassis are 32%~54% higher than steel chassis and 66~78% stiffer than the steel chassis**.**

V. Vamsi Krishnam Raju, B. Durga Prasad, M. Balaramakrishna, Y. Srinivas[5] in his Modeling and Structural Analysis of Ladder Type Heavy Vehicle Frame have done analysis on heavy vehicle frame of a TATA 1109 EX2 vehicle. The analysis is done in this work with three different composite materials namely Carbon/Epoxy, E-glass/Epoxy and S-glass/Epoxy subjected to the same pressure as that of a steel frame and the results are tabulated as below

Material	Mass (kg)	Max.Normal stress (MPa)	Max.Equivalent stress (MPa)	Max.Deformation (mm)
Structural steel	385	3359	17686	5.68
Carbon/ Epoxy	79	2312	16769	4.03
E-glass/ Epoxy	128	2888	17055	9.45
S-glass/ Epoxy	123	2888	17055	8.64

Archit Tomar & Dheer Singh [6] in his work of static analysis, modal analysis and design modification in chassis frame have tried to optimize weight of frame by using composite material. Author designed the EICHER 11.10 chassis frame in CATIA V5R19 and structural analysis is done in ANSYS as shown below fig.



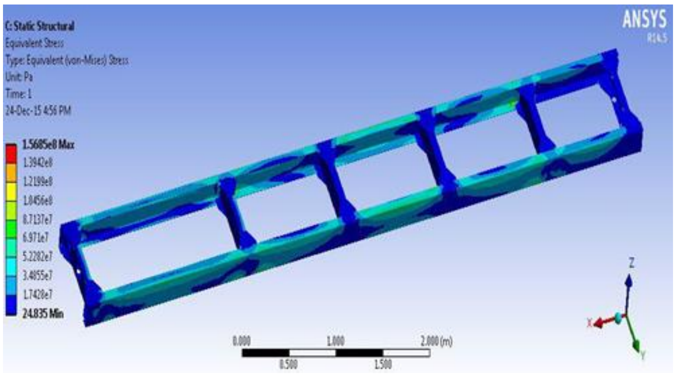


Figure 3. EICHER 11.10 chassis frame in CATIA V5R19

From the weight optimization table in this paper is clear from above table that it is possible to decrease weight by using composite material and after modified the design there is further decrease in weight. By weight reduction in chassis frame it helps in increasing the efficiency of an auto vehicle.

Table : Weight Optimizing

Chassis Design	Material	Weight
conventional	**Steel- 52**	**334.31 kg**
conventional	**Carbon/epoxy**	**63.910**
modified	**carbon /epoxy**	**63.208**

2. Composite leaf spring for light passenger vehicles

The suspension leaf spring is one of the potential items for weight reduction in automobiles as it accounts for 10% - 20% of the unstrung weight. This achieves the vehicle with more fuel efficiency and improved riding qualities. The introduction of composite materials has made it possible to reduce the weight of leaf spring without any reduction on load carrying capacity and stiffness. Since, the composite materials have more elastic strain energy storage capacity and high strength to weight ratio as compared with those of steel, multi-leaf steel springs are being replaced by mono-leaf composite springs. The composite material offer opportunities for substantial weight saving. The leaf spring should absorb the vertical vibrations and impacts due to road irregularities by means of variations in the spring deflection so that the potential Energy is stored in spring as strain energy and then released slowly. So, increasing the energy storage capability of a leaf spring ensures a more compliant suspension system. According to the studies made a material with maximum strength and minimum modulus of elasticity in the longitudinal direction is the most suitable material for a leaf spring. Fortunately, composites have these characteristics.

M.Venkatesan and D.Helmen Devaraj[7] worked on the project which describes design and experimental analysis of composite leaf spring made of glass fiber reinforced polymer. This paper has an objective to compare the load carrying capacity, stiffness and weight savings of composite leaf spring with that of steel leaf spring. The design constraints are stresses and deflections. The dimensions of an existing conventional steel leaf spring of a light commercial vehicle are taken. Same dimensions of conventional leaf spring are used to fabricate a composite multi leaf spring using E-Glass/Epoxy unidirectional laminates. Static analysis of 2-D model of conventional leaf spring is also performed using ANSYS 10 and compared with experimental results. Finite element analysis with full load on 3-D model of composite multi leaf spring is done using ANSYS 10 and the analytical results are compared with experimental results. Compared to steel spring, the composite leaf spring is found to have 67.35% lesser stress, 64.95% higher stiffness and 126.98% higher natural frequency than that of existing steel leaf spring. A weight reduction of 76.4% is achieved by using optimized composite leaf spring.

Gulur Siddaramanna Shiva Shankar and Sambagam Vijayarangan[8] designed and analyzed the composite leaf spring. In this work, analysis carried out for composite leaf spring with bonded end joints for Glass/Epoxy, Graphite/Epoxy and Carbon/Epoxy composite materials and the results were compared with steel leaf spring with eye end. Also in this project experimental analysis is done. The steel and composite leaf springs are tested by using leaf spring test rig according to the standard procedures recommended by SAE. Experimental Results are then compared with FEA software result. Result are tabulated as below.

Material	**Static load (N)**	**Maximum deflection (mm)**		**Maximum stress (MPa)**		**Weight (kg)**
		FEA	**Experimental**	**FEA**	**Experimental**	
Steel	**3980**	**90**	**107.5**	**511**	**503.3**	**26.0**
E-Glass/Epoxy	**4250**	**94**	**105.0**	**466**	**473.0**	**3.88**
Graphite/Epoxy	**–**	**68**	**–**	**422**	**–**	**2.33**
Carbon/Epoxy	**–**	**62**	**–**	**413**	**–**	**2.39**

3. Composite Bumper for Light Passenger Vehicles

The bumper is a safety system is used to observe the low speed collision. It is placed in car body. The car bumper is designed to prevent or reduce physical damage to the front and rear ends of passenger motor vehicles in low-speed collisions. This bumper usually made up of steel. Steel bumper have many advantages such as good load carrying capacity. In spite of its advantages, it stays back in low strength to weight ratio.

So to achieve objective of better fuel economy attempt has been made to reduce its weight.

S. Prabhakaran, K. Chinnarasu, and M. Senthil Kumar[9] the presented the work involving the replacement of steel bumper used in passenger vehicles with a composite bumper made of glass/epoxy composites. In this work the design and fabrication of composite bumper made up of glass fiber reinforced polymer is carried out by which weight of the bumper can be reduced. Fabrication of composite bumper is carried out by hand layup process by using E- Glass/ Epoxy bidirectional laminates. Composite bumper is analyzed and Charpy impact tests are carried out. Compared to steel bumper, the composite bumper is found to have 64% higher factor of safety and 80% less in cost. From the fabrication it is found that the weight reduction of 53.8% is achieved using composite material without sacrificing the strength. Comparative analysis of this work can be understood from below table.

Description	Steel bumper	Composite bumper	% Reduction
Weight	5.15	2.38	53.78%
Cost	3600	820	77.22%
Impact strength	3.25	7.35	-
Max.Stess	369.168	142.471	-
F.O.S.	1.2	3.4	-

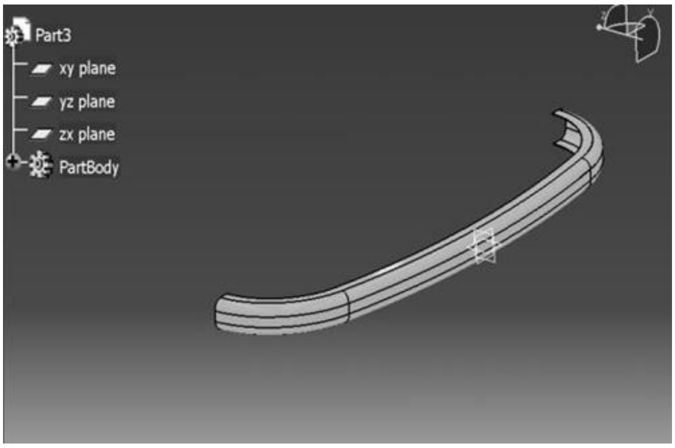


Figure 4. Model of the Bumper

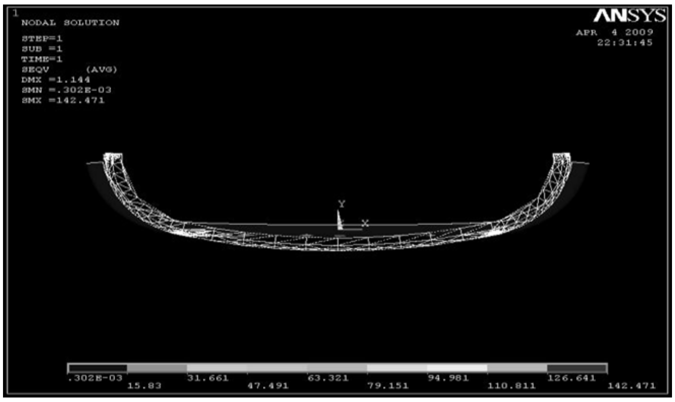


Figure 5. Stress Distribution of Composite Bumper

4. Composite Material Automotive Driveshaft for light passenger vehicles

Drive shaft is the important automotive part in any automobile playing a major role in power transmission. It is also usually made up of steel material. With considering the drawbacks of existing steel material, an attempt has been made to replace it with efficient composite material.

Amol B. Rindhe and S. R. Wagh[10] presented a work which deals with the replacement of conventional composite material drive shaft with a Eglass carbon /Epoxy,High strength carbon /Epoxy and High module carbon /Epoxy to overcome the drawback of conventional composite material drive shaft. These papers suggests the best composite material for drive shaft and improve the life of drive shaft and also saving the percentage of material.Here in this papar it is found that the bending natural frequency of HS and HM carbon/epoxy drive shaft is nearly equal to steel drive shaft so less chance of failure. Also the life of HS and HM carbon/epoxy drive shaft is more, compare to other composite material drive shaft.

5. Two wheeler composite suspension frame

Suspension frame is basically supports the shock absorber of the vehicles. It is the integral part of chassis frame. As it is subjected to shocks on road, It is essential that the frame should not buckle on uneven road surfaces and that any distortions which may occur should not be transmitted to the body. The frame must therefore be torsion–resistant. It should be as rigid as possible. Thus with considering all these requirement research has been done to replace and analyzed it with composite material

T. Kondaiah, and D.Pavan Kumar[11] presented the work with the aim of the project to model a frame of a two wheeler using 3D modeling software Pro/Engineer. Two models of suspension frames are designed for pipe type and rectangular cross sections. Calculations are done to determine the displacement and stress by applying pressure. In this project Authors have modeled a suspension frame used in two wheeler. The original cross section is circular are changing the model to rectangular cross section. Modeling is done in Pro/Engineer. They have done Structural & Modal analysis on both models of suspension frame using materials Steel and Carbon Epoxy. After static analysis modal analysis has done. Modal analysis is mainly used to determine the frequency of suspension frame model. Present used material for suspension frame is steel. They have replaced it with Carbon Epoxy. It is observed that density of Carbon Epoxy is less than that of Steel and concluded that the weight of the frame reduces when Carbon Epoxy is used.

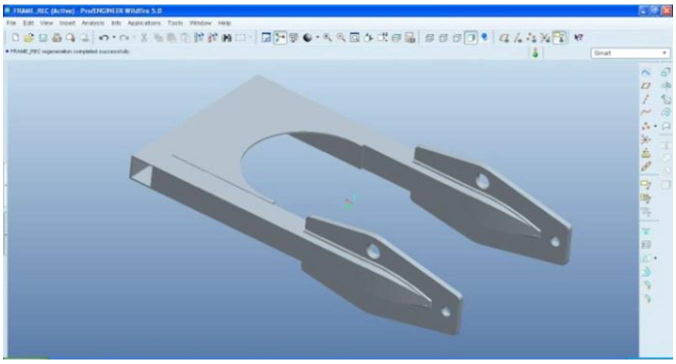


Figure 6. 3D model of Circular Suspension Frame

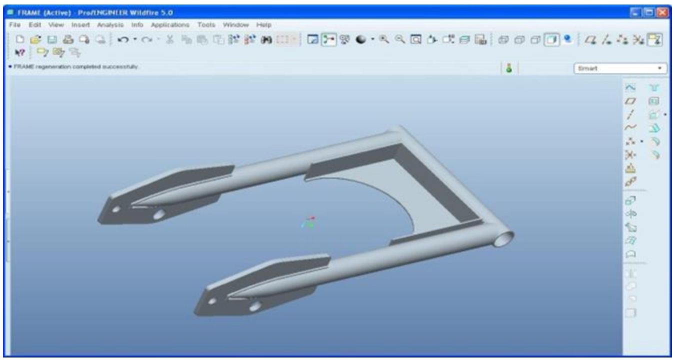


Figure 7. 3D model of Rectangular Suspension Frame

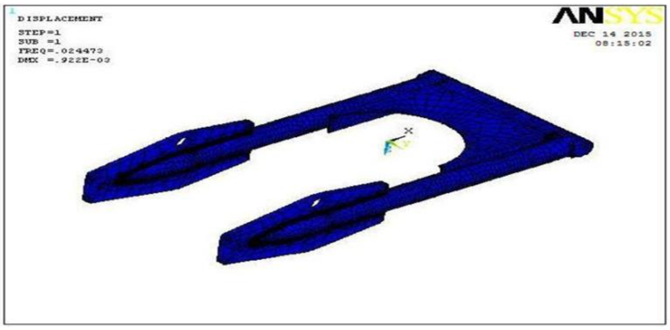


Figure 8. Modal analysis of Circular Suspension

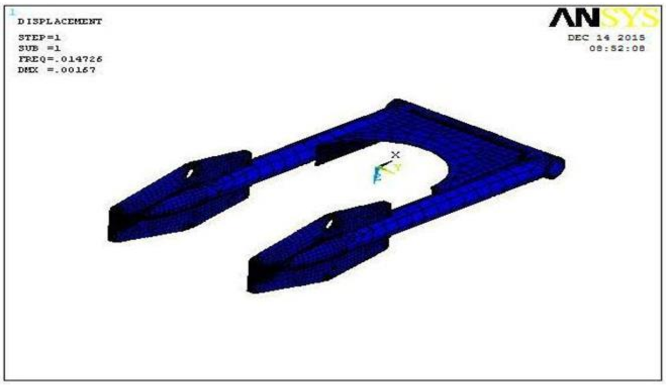


Figure 9. Frame Modal analysis of rectangular Suspension Frame

III. RESULTS AND DISCUSSION

Current status of research on Two wheeler chassis frame

The motorcycle chassis consists of the frame, suspension, wheels and brakes. Frame Motorcycles have a frame made of steel, aluminum or an alloy. The frame consists mostly of hollow tubes and serves as a skeleton on which components like the gearbox and engine are mounted. Presently some work has been done in design and optimization for weight reduction of chassis frame by bringing about change in the design and varying with different metallic material.

Prakash Katdare, and S.C.Shilwant[12] worked with the use of strong design and simulation tools like CATIA, Hyper-Mesh and ANSYS optimization of existing Bajaj Pulsar 180 DTS-i chassis is done. The optimization process consists of CAD model generation of existing chassis in CATIA, its analysis using Hyper-Mesh and ANSYS. An alternate material is used for the redesign and analysis of model. Experimentation is also done for validation of proposed model.

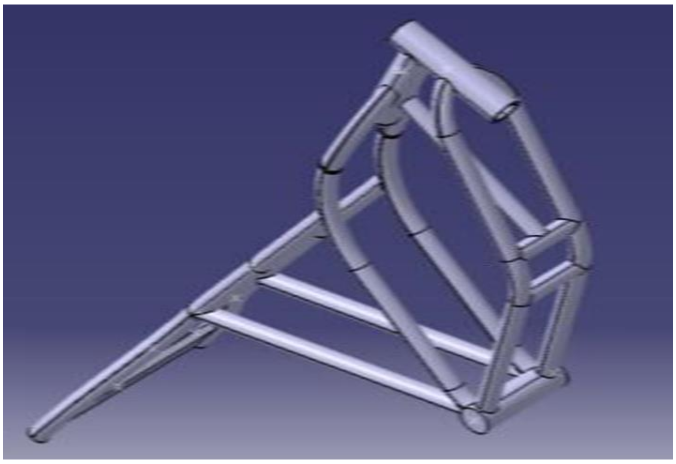


Figure 10. CAD model in CATIA V5

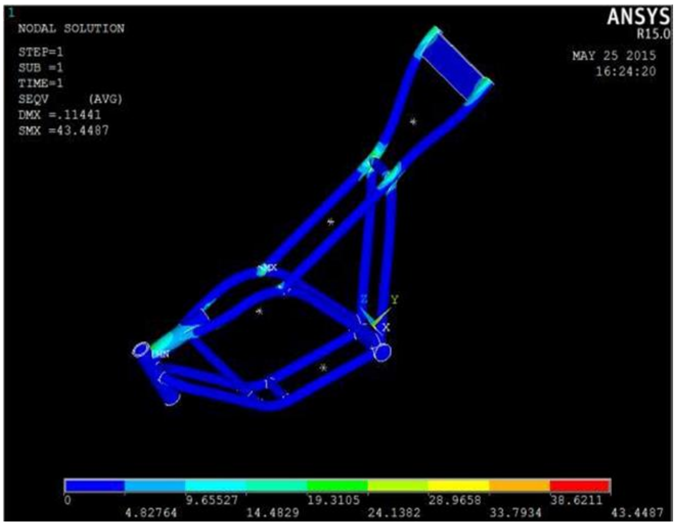


Figure 11. Steel Material

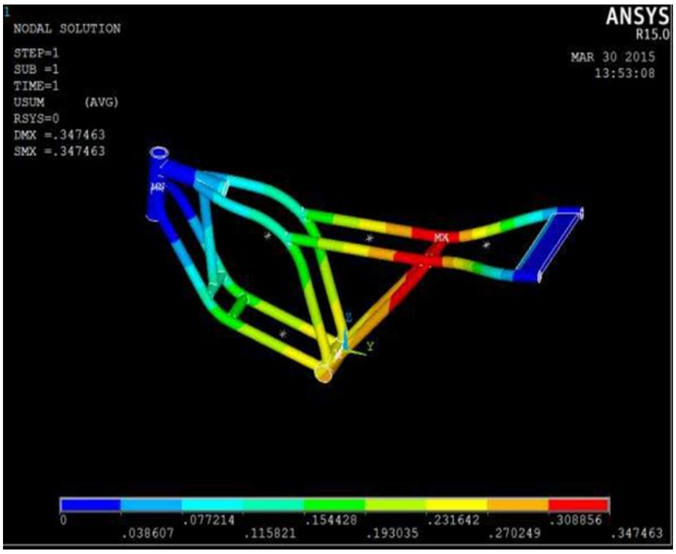


Figure 12. Aluminum Alloy

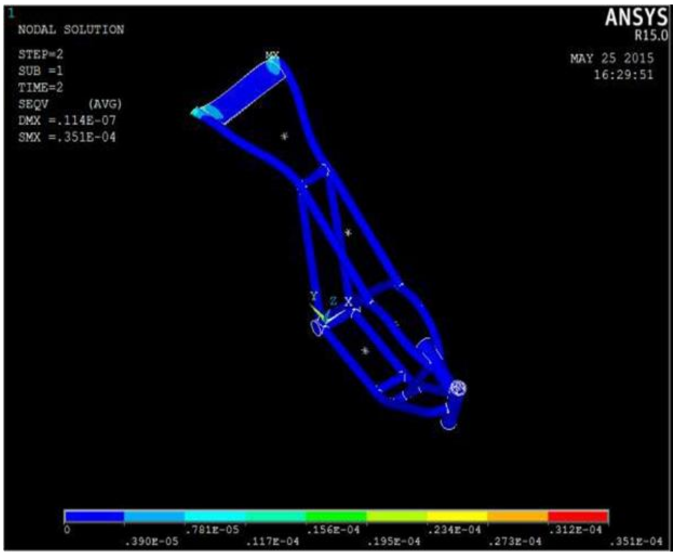


Figure 13. Titanium Alloy

Thus by using aluminum alloy a prototype is prepared for experimentation. It is concluded from this work that the new material has less density compared to other materials used and is also cheap in cost, and is the best suited alternate material for the chassis and is expected to perform better with satisfying amount of weight reduction.

IV. CONCLUSION

From the above literature survey it has been concluded that there are growing applications composite materials in automotive industries for manufacturing various automotive parts because of their outstanding properties and benefits. From above work it has been reveal that considerable work has been done in design and analysis of heavy vehicle chassis frame [5] and aircraft composite materials parts [1]. In case two wheeler some work have been done such as design and analysis of composite suspension frame [9], design and optimization of chassis frame [10].But up till now no work has been done on application of composite material in two wheeler chassis frame. Finding this scope and chassis frame being most crucial part in two wheeler so my project mainly focus on its design and analysis in composite material and thereby reducing overall weight of vehicle with increasing its fuel efficiency.

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