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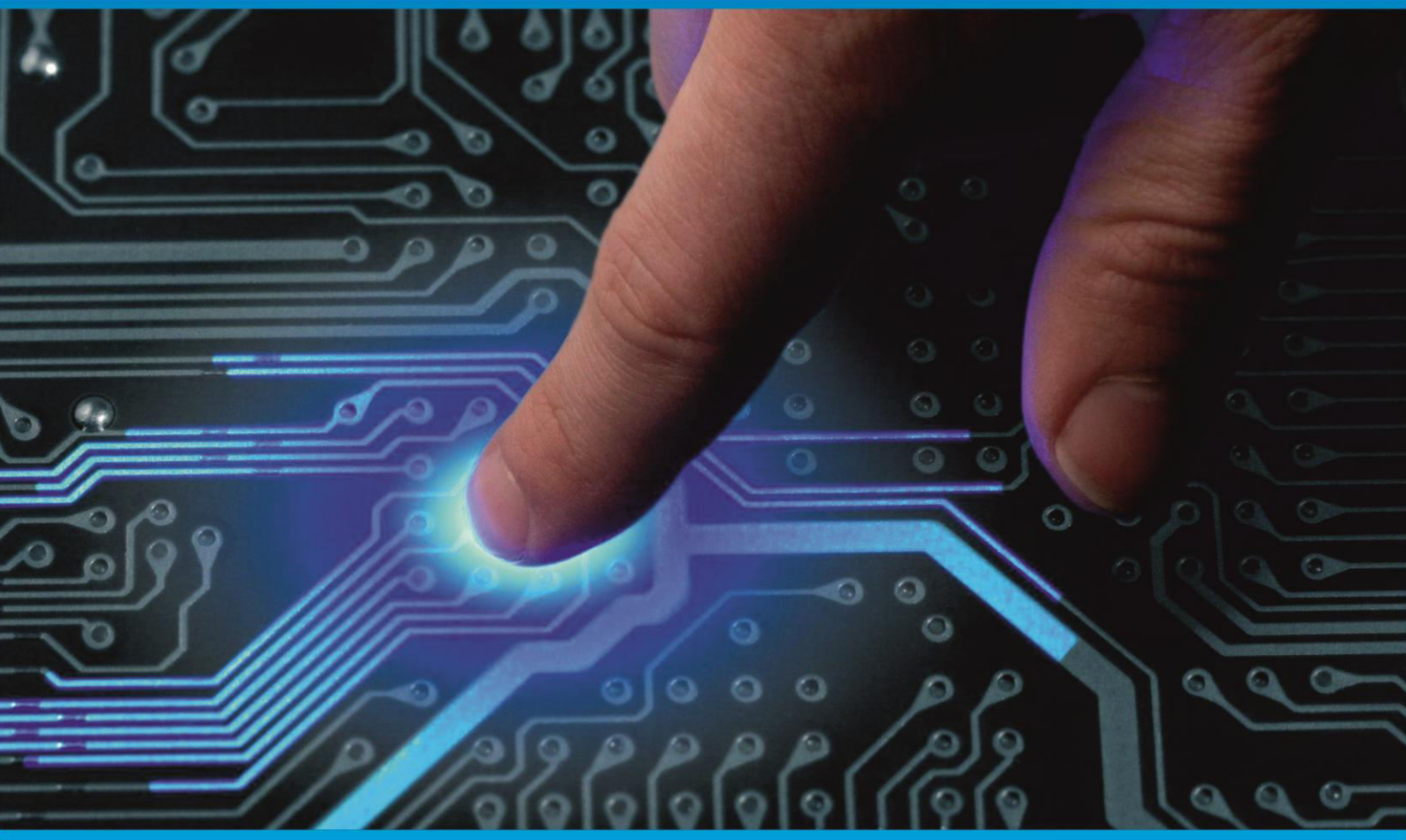

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# Design and Analysis of Swift Car Chassis by Using Glass Fiber Material: A Survey

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**ABSTRACT:** The automotive chassis is considered to be one of the significant structures of an automobile. It is usually made up of steel frame, which holds the body and motor of an automotive vehicle. More precisely, automobile chassis is a skeletal frame on which various mechanical parts like engine, tires, axle assemblies, brakes, steering etc, are mounted. It provides strength and flexibility to vehicle. In the present work an attempt is made to replace the chassis frame made up of steel with a composite material like E-Glass Epoxy. At first the chassis frame is modeled by considering c-cross section in CATIA V5 software and then it is imported to ANSYS13.0. The analysis is done on EGlass Epoxy subjected to similar conditions as that of chassis made up of steel. The results are then estimated to finalize the best among two materials.

**KEYWORDS:** Chassis frame, E-Glass Epoxy, CATIA, ANSYS

## I. INTRODUCTION

Introduction of Chassis Frame: Chassis is a French term and was initially used to denote the frame parts or Basic Structure of the vehicle. It is the back bone of the vehicle. A vehicle with out body is called Chassis. The components of the vehicle like Power plant, Transmission System, Axles, Wheels and Tyres, Suspension, Controlling Systems like Braking, Steering etc., and also electrical system parts are mounted on the Chassis frame. It is the main mounting for all the components including the body. So it is also called as Carrying Unit. The following main components of the Chassis are 1.Frame: it is made up of long two members called side members riveted together with the help of number of cross members. 2.Engine or Power plant: It provides the source of power 3.Clutch: It connects and disconnects the power from the engine fly wheel to the transmission system, 4. Gear box. The frame is the main part of the chassis on which remaining parts of chassis are mounted. The frame should be extremely rigid and strong so that it can withstand shocks, twists, stresses and vibrations to which it is subjected while vehicle is moving on road. It is also called underbody. The frame is supported on the wheels and tire assemblies. The frame is narrow in the front for providing short turning radius to front wheels. It widens out at the rear side to provide larger space in the body. 1.1 TYPES OF FRAME: There are three types of frames : a) Conventional frame b) Semi integral frame, and c) Integral frame. Conventional Frame: It is non load carrying frame. The loads of the vehicle are transferred to the suspensions by the frame. This suspension in the main skeleton of the vehicle which is supported on the axles through springs. The body is made of flexible material like wood and isolated frame by inserting rubber mountings in between. The frame is made of channel section or tubular section of box section. Example :This type of frame is used for trucks. Semi-integral Frame: In this case the rubber mountings used in conventional frame between frame and suspension are replaced by more stiff mountings. Because of this some of the vehicle load is shared by the frame also. This type of frame is heavier in construction.Example Popular in European and American car. Integral Frame: In this type of construction, there is no frame. It is also called unitized frame body construction. In this case, the body shell and underbody are welded into single unit. The underbody is made of floor plates and channel and box sections welded into single unit. This assembly replaces the frame. This decreases the overall weight compared to conventional separate frame and body construction.

**Types of Sections Used In Frames:**

Ladder Frame: A ladder frame car chassis is a common type of frame used as a base for vehicles, creating a solid base from the shape that the name suggests.

Backbone: A substantial central component is necessary for a backbone car chassis, connecting the front and rear of the entire frame.

Monologue : A monologue car chassis is one that uses metal that is molded from sheets of the material, which is the same method used to build other parts of the frame. This type of chassis is similar to a unibody type.

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Space: A space chassis can also be known as tubular even though it is not tubular in the true sense.The components are welded together to create a strong frame that comprises some flexibility.
Combination: You will often find that a car chassis is not any single types, taking elements from arange of different types to create a version that is best suited to the car frame.

## II. DIFFERENT MATERIALS USED FOR CHASSIS MAKING

Steel: The main factors of selecting material specially for body is wide variety of characteristics such as thermal,chemical or mechanical resistance, ease of manufacture and durability. So if we want to choose a material with thes characteristics, Steel is the first choice. There was many developments in irons and steels over the past couple decade that made the steel more light-weight, stronger, stiffer and improving other performance characteristics. Application include not only vehicle bodies, but also engine, chassis, wheels and many other parts. Iron and steel form the critica elements of structure for the vast majority of vehicles, and are low-cost materials. The prime reason for using steel I the body structure is its inherent capability to absorb impact energy in a crash situation. The prime reason for usin steel in the body structure is its inherent capability to absorb impact energy in a crash situation.

Aluminum: There are a wide variety of aluminum usage in automotive powertrain, chassis and body structure. Use of aluminum can potentially reduce the weight of the vehicle body. Its low density and high specific energy absorption performance and good specific strength are its most important properties. Aluminum is also resistance t corrosion. But according to its low modulus of elasticity, it cannot substitute steel parts and therefore those parts need to be re-engineered to achieve the same mechanical strength, but still aluminum offers weight reduction. Recent developments have shown that up to 50% weight saving for the body in white (BIW) can be achieved by the substitution of steel by aluminum. This can result in a 20-30% total vehicle weight reduction. The cost of aluminum and price stability is its biggest obstacle for its application.

Magnesium: There are a wide variety of aluminum usage in automotive powertrain, chassis and body structure. Use of aluminum can potentially reduce the weight of the vehicle body. Its low density and high specific energy absorption performance and good specific strength are its most important properties. Aluminum is also resistance to corrosion. But according to its low modulus of elasticity, it cannot substitute steel parts and therefore those parts nee to be re-engineered to achieve the same mechanical strength, but still aluminum offers weight reduction. Recent developments have shown that up to 50% weight saving for the body in white (BIW) can be achieved by the substitution of steel by aluminum. This can result in a 20-30% total vehicle weight reduction.

E Glass Epoxy fiber: Glass has been the predominant fiber for many civil engineering applications because of a economical balance of cost and specific strength properties. Glass fibers are commercially available in E-Glass formulation (for electrical grade), the most widely used general-purpose form of composite reinforcement, hig strength S-2® glass and ECR glass (a modified E Glass which provides improved acid resistance).

## III. LITERATURE SURVEY

“Swami K.I. et al. (Jan. 2014)
The Automotive chassis is considered as the backbone of the vehicle. An important consideration in chassis design is to have adequate bending stiffness for better handling characteristics. So strength and stiffness are two important criteria for the design of the chassis. This paper related with work performed towards the static structural analysis of the truck chassis. Structural systems like the chassis can be easily analyze using the finite element techniques. So a proper finite element model of the chassis is to be developed. The chassis I modeled in ANSYS. Analysis is done using the same software”.

“Pankaj Saini and Ashish Goel stated that the comparative analysis between the conventional steel leaf spring and composite material like polymer reinforced with glass fiber i:e Carbon epoxy, E-glass based epoxy and Graphite epoxy used for designing leaf spring. They done the modeling in the Auto-CAD 2012 software and ANSYS 9.0 use for analysis. the static analysis results shows that maximum displacement of conventional steel leaf is 10.16 mm an that for E-glass based epoxy is 15 mm for Graphite epoxy is 15.75 mm and for carbon/epoxy 16.21 mm the values of stress for conventional steel leaf is 67 N/mm and 163.22 Mpa, 663.68 Mpa, and 300 Mpa, for composite material resp Out of that graphite epoxy has more stress the conventional material steel leaf so E-glass based epoxy leaf spring canbe replaced from stress and strain point of view”.

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"Design and Analysis of Composite Drive Shaft using ANSYS and Genetic Algorithm". This study deals wit the review of optimization of drive shaft using the Genetic Algorithm and ANSYS. Here the replacement of the conventional steel is done by the composite materials of glass fiber of carbon fiber and optimization is done for further selection of most effective material Genetic algorithm technique is used. Substitution of composite material over th conventional steel material for drive shaft has increasing the advantages of design due to its high specific stiffness and strength".

"N.V.Dhandapani, G Mohan kumar, K.K.Debnath (2012) have used Finite element methods to study th effect of various stress distribution using Ansys software. To investigate the field failure of 100Ton dumper the introduced gussets in failure area. After modification the chassis structure was validated by linear static analysis an found that the modified chassis was safe".
"Kutay Yilmazcoban, Yasar Kahraman (2011) have studied and optimized the thickness of a middle tonnage truck chassis by using Finite Element technique. The main objective of this work was to reduce the material usage through that gaining reduction in material cost. They had analyzed three types of thickness material to chassis and compared the results by stress and displacement. Study reveals that the 4mm thickness is safe enough to carry 15ton Load".

## IV. PROPOSED SYSTEM

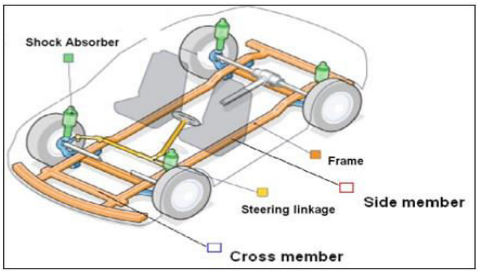


Fig1. Proposed System Chassis Layout

Automotive chassis is a skeletal frame on which various mechanical parts like engine, tires, axle assemblies, brakes, steering etc. are bolted. The chassis is considered to be the most significant component of an automobile. It is the most crucial element that gives strength and stability to the vehicle under different conditions. Automobile frames provide strength and flexibility to the automobile. The backbone of any automobile, it is the supporting frame to which the body of an engine, axle assemblies are affixed. Tie bars, that are essential parts of automotive frames, are fasteners that bind different auto parts together. Automotive chassis is considered to be one of the significant structures of an automobile. It is usually made of a steel frame, which holds the body and motor of an automotive vehicle. More precisely, automotive chassis or automobile chassis is a skeletal frame on which various mechanical parts like engine, tires, axle assemblies; brakes, steering etc. are bolted. At the time of manufacturing, the body of a vehicle is flexibly molded according to the structure of chassis. Automobile chassis is usually made of light sheet metal or composite plastics. It provides strength needed for supporting vehicular components and payload placed upon it. Automotive chassis or automobile chassis helps keep an automobile rigid, stiff and unbending. Auto chassis ensures low levels of noise, vibrations and harshness throughout the automobile.

## V. CONCLUSION

The goal of this study is to investigate the use of Glass Fiber as an alternative to the present automobile chassis. And will be tested under standard boundary conditions to determine its stress and deformation.

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