MODELING AND STRUCTURAL ANALYSIS OF A HEAVY VEHICLE CHASSIS FOR COMPOSITE MATERIALS FOR OPTIMUM LOAD CONDITIONS

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ABSTRACT: Composite cloth is a cloth composed of or more excellent levels (matrix section and dispersed segment) and having bulk houses drastically exceptional from the ones of any of the additives. Different kinds of composite material are available and certainly one of its far polymer matrix composite. It can be very popular because of their low fee and smooth fabrication techniques. It has the benefits of immoderate tensile strength, excessive stiffness and precise corrosion resistance and so on. For cars, chassis consists of an meeting of all of the crucial elements of a truck (with out the body) to be ready for operation on the road. In our assignment, layout and version the heavy automobile chassis with the aid of using pro/engineer software program software, through taking the information from the l & t heavy vehicle model by means of using opposite engineering strategies. Present used cloth for chassis is metallic. The crucial purpose is to replace the chassis cloth with IM 7 fiber & 997 epoxy. By using metal, the load of the chassis is more in contrast with IM 7 fiber & 997 epoxy, because its density is more. Structural and modal assessment is completed on chassis for optimizing above parameters underneath 10tons load. And we're the use of layer stacking technique for 3 and 5 layers for evaluation of IM 7 fiber & 997 epoxy. Software used for modeling seasoned/engineer and for evaluation ANSYS.

INTRODUCTION TO CHASSIS

The chassis paperwork the primary shape of the present day automobile. A massive variety of designs in pressed-metal body shape a skeleton on which the engine, wheels, axle assemblies, transmission, guidance mechanism, brakes, and suspension members are hooked up. During the producing technique the body is flexibly bolted to the chassis. This combination of the frame and frame plays kind of capabilities. It absorbs the reactions from the actions of the engine and axle, gets there motion forces of the wheels in acceleration and braking, absorbs aerodynamic wind forces and avenue shocks through the suspension, and absorbs the vital strength of effect within the occasion of an coincidence.

INTRODUCTION OF CHASSIS FRAME:

Chassis is a French term and became first of all used to indicate the body additives or Basic Structure of the auto. It is the back bone of the car. A automobile without body is referred to as Chassis. The components of the auto like Power plant, Transmission Sys-tem, Axles, Wheels and tyre, Suspension, Control-ling Systems like Braking, Steering etc., and additionally electric device factors are installed at the Chassis frame. It is the principle mounting for all of the additives which includes the body. So it is also known as Carrying Unit.

Layout of Chassis and Its Main Components:

The following maximum crucial components of the Chassis are

1. Frame: it is made up of long individuals called component people riveted together with the help of wide variety of skip individuals.
2. Engine or Power plant: It offers the supply of power
3. Clutch: It connects and disconnects the electricity from the engine flywheel to the transmission machine.
4. Gear Box
5. U Joint
6. Propeller Shaft
7. Differential

Design Goals

Chassis and Body Structure

The car layout starts up with conceptual studies to define size, wide variety and area of un-pushed and pressure axles, form of suspension, engine power, transmission, tire size and axle bargain ratio, cab size and auxiliary system. The selected configuration needs to be appropriate for the considered transportation duties and have to in shape the triumphing production line. Either new car kind is generated or a positive development over present types must be done. Because of the fierce opposition, and advanced technology in engineering, manufacturing and service and strenuous artwork is needed to reap success.

TYPES OF CHASSIS

You have heard the phrase "Chassis" a whole lot time in vehicle however till now you have got confusion about it. But Today I am going to inform you approximately it. Chassis is the lowest of a vehicle. It consist engine, transmission device, brake device, suspension machine, steering system, cooling system, wheels and plenty of others.

There are types of chassis:

1. Conventional chassis or frame-full chassis

In this form of chassis the frame is made as a separate unit after which joined with ladder body. It helps all of the structures in a automobile which include the Engine, Transmission device, Steering device, Suspension machine.

Advantage

- Higher load ability and electricity

Disadvantage

- The body has a bent to vibrate effortlessly and the overall car dealing with and refinement is decrease.

CLASSIFICATION OF CHASSIS

Chassis may be labeled on the idea of numerous parameters which include Control, Fitting to engine, range of wheels suited to the car and so on.

Generally chassis is assessed into 3 sorts on the basis of frame used, they are

- Ladder chassis
- Backbone chassis
- Monocoque chassis

LADDER CHASSIS

- Ladder chassis is taken into consideration to be one of the oldest sorts of automobile chassis this is nonetheless used by maximum of the SUVs until nowadays.
- As its call connotes, ladder chassis resembles a form of a ladder having two longitudinal rails inter related by means of several lateral and cross braces.• Easier to repair after accidents. This is vital for taxicabs, due to the fact damaged bolt-on fenders can be replaced .With the cab returned to incomes popularity right now, whereas a uni frame frame could require straightening by means of paid specialists on a device luxurious to rent — with the cab laid up for restore longer.
- Grand-Am lets in tubular space body vehicles to update their uni body counterparts, because the vehicles can effortlessly be repaired with new clips.

Motors which have ladder chassis:

- Opel Olympia
- Lincoln vehicle
- Toyota tundra
- Ford panther series
- Citroen traction avant

INTRODUCTION TO CAD

Computer-aided layout (CAD) is the usage of computer structures (or workstations) to beneficial useful resource within the introduction, amendment, assessment, or optimization of a design. CAD software is used to boom the productivity of the fashion designer, enhance the superb of layout, beautify communications through documentation, and to create a database for production. CAD output is often inside the shape of digital files for print, machining, or different production operations. The term CADD (for Computer Aided Design and Drafting) is also used.

INTRODUCTION TO CREO

PTC CREO, previously referred to as Pro/ENGINEER, is three-d modeling software program applied in mechanical engineering, layout, manufacturing, and in CAD drafting provider corporations. It modified into one of the first 3D CAD modeling packages that used a rule-based parametric device. Using parameters, dimensions and functions to seize the behavior of the product, it is able to optimize the improvement product further to the format itself.

The name come to be changed in 2010 from Pro/ENGINEER Wildfire to CREO. It changed into introduced by means of way of the business enterprise who superior it, Parametric Technology Company (PTC), for the duration of the release of its suite of format merchandise that consists of programs collectively with meeting modeling, 2D orthographic views for technical drawing, finite element analysis and greater

ADVANTAGES OF CREO PARAMETRIC SOFTWARE

1. Optimized for version-primarily based absolutely agencies
2. Increased engineer productivity
3. Better enabled concept format

four. Increased engineering competencies

five. Increased production abilities

6. Better simulation
7. Design talents for additive production

CREO parametric modules:

- Sketcher
- Part modeling
- Assembly
- Drafting

2.1.1 2D DRAWINGS

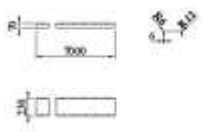


Figure 2.1.5 MAIN CHANNEL

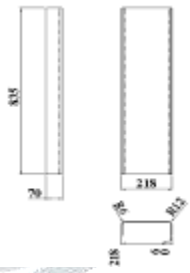


Figure 2.1.6 SUPPORT CHANNEL

2.1.2 MODEL OF CHASSIS

Figure 2.1.1 MAIN CHANNEL

Figure 2.1.2 SUPPORT CHANNEL

Figure 2.1.4 ASSEMBLY

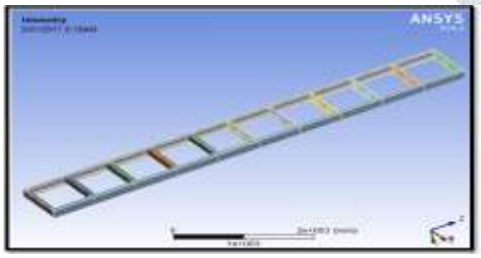
INTRODUCTION TO FEA

Finite detail evaluation is a way of solving, commonly approximately, remarkable problems in engineering and technological understanding. It is used in particular for troubles for which no particular solution, expressible in some mathematical shape, is available. As such, it's miles a numerical instead of an analytical approach. Methods of this type are desired due to the truth analytical techniques cannot cope with the real, complex issues which are met with in engineering.

STRUCTURAL AND MODAL ANALYSIS FOR CHASSIS FRAME

STRUCTURAL ANALYSIS

MATERIAL - CARBON STEEL

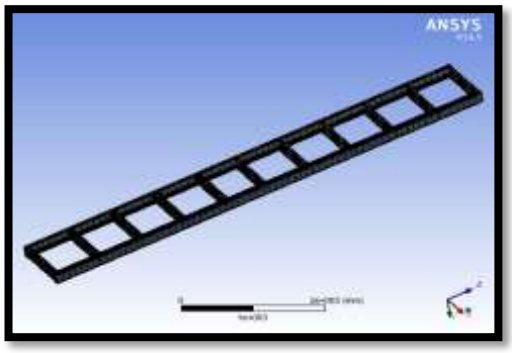


MATERIAL PROPERTIES OF HIGH CARBON STEEL

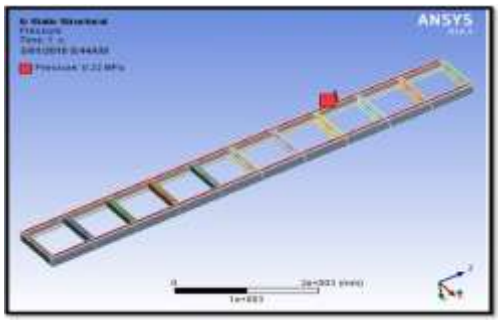
Density : 8260 kg/mm3

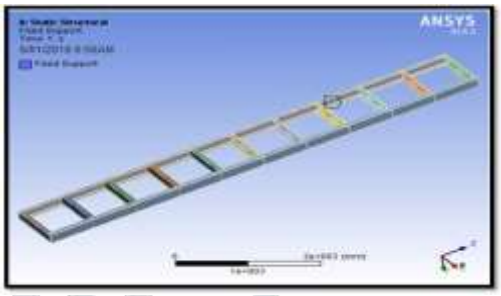
Young's modulus : 235000Mpa

Possions ratio : zero.313

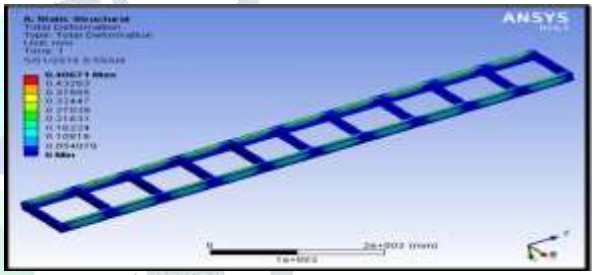


PRESSURE -0.22MPa.

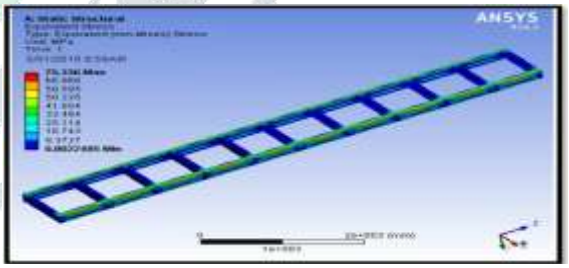




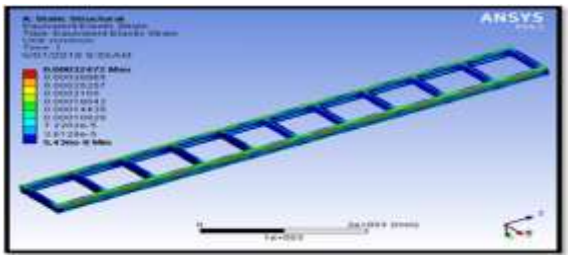
TOTAL DEFORMATION



VON-MISES STRESS



VON-MISES STRAIN



MATERIAL-IM7 FIBER

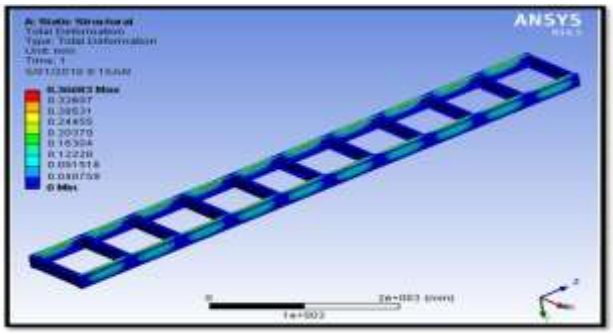
MATERIAL PROPERTIES OF IM7 FIBER

Density : 1780 kg/mm^3

Young's modulus : 276000Mpa

passions ratio : 0.36

TOTAL DEFORMATION



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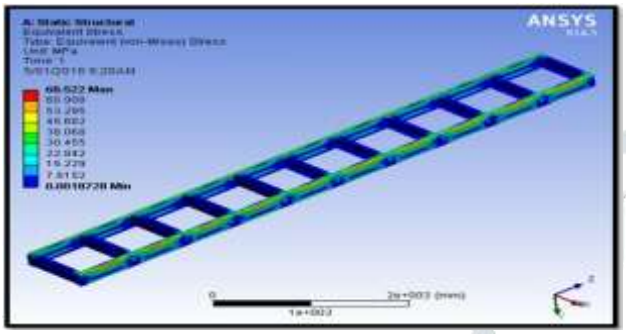

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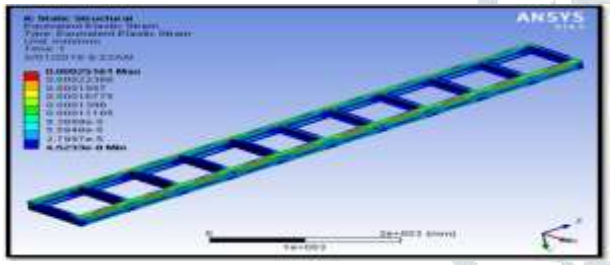
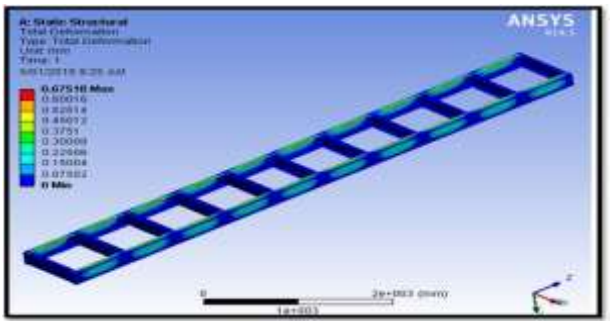


MATERIAL-997 EPOXY

MATERIAL PROPERTIES OF 997-EPOXY

Density : 1610 kg/mm^3
Young's modulus : 145000Mpa
passions ratio : 0.313

TOTAL DEFORMATION



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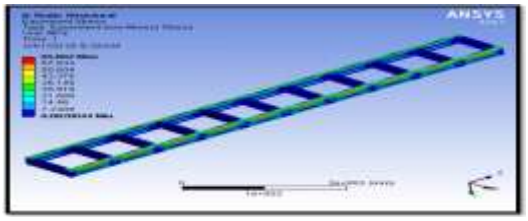
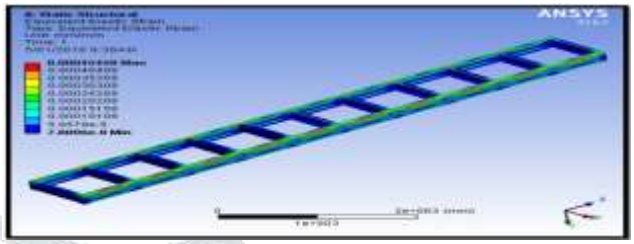
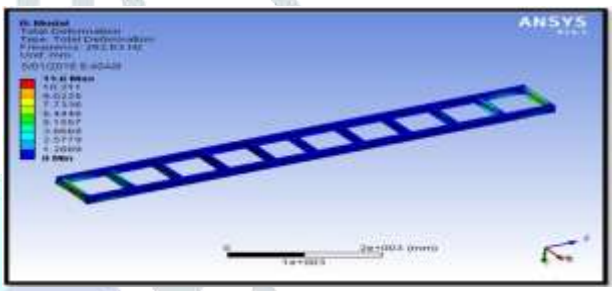


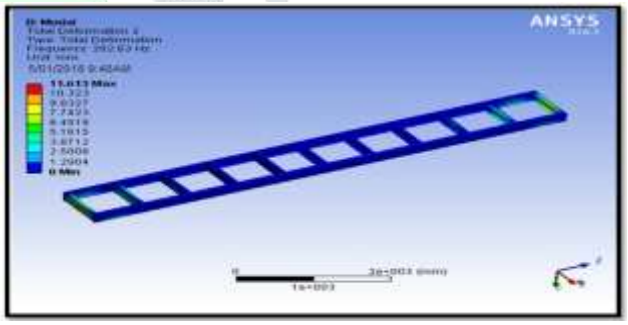
VON-MISES STRAIN



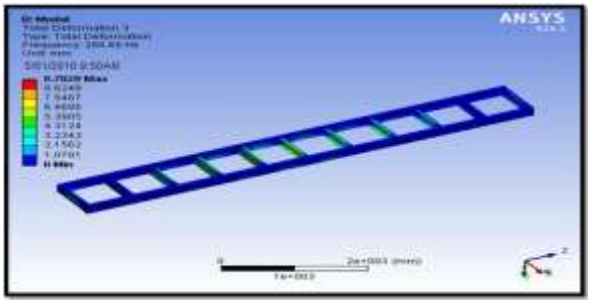
TOTAL DEFORMATION 1:



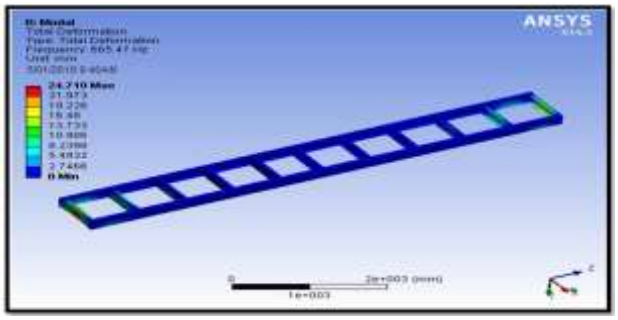
TOTAL DEFORMATION 2



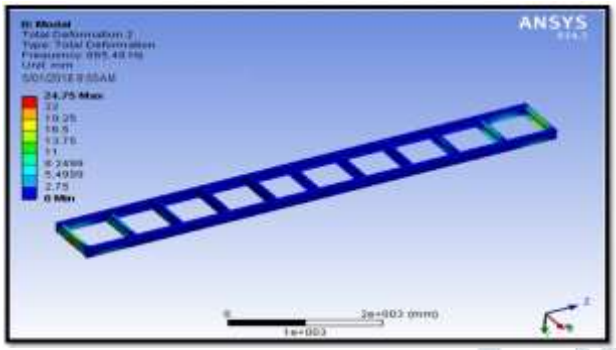
TOTAL DEFORMATION 3



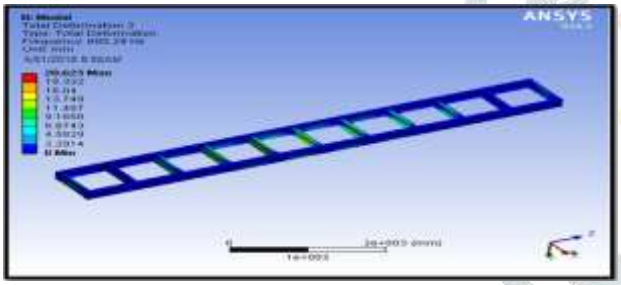
MATERIAL - IM7 FIBER
TOTAL DEFORMATION 1



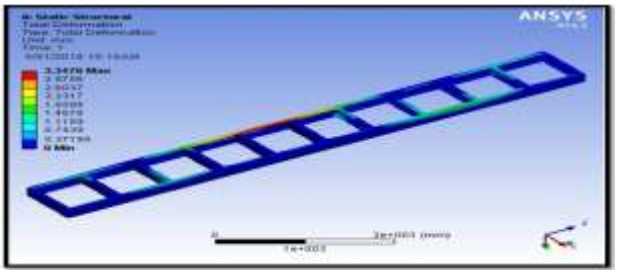
TOTAL DEFORMATION 2



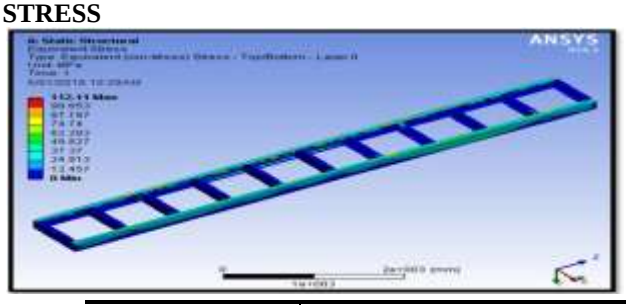
TOTAL DEFORMATION 3



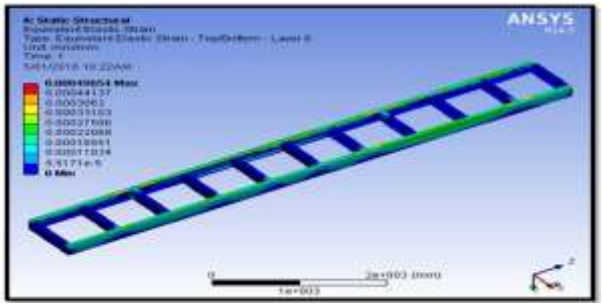
LAYER STACKING DEFORMATION



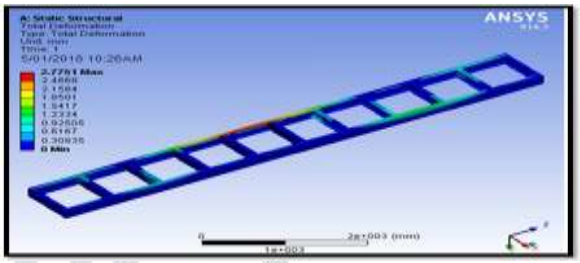
STRESS



STRAIN



MATERIAL – IM7 FIBER
DEFORMATION



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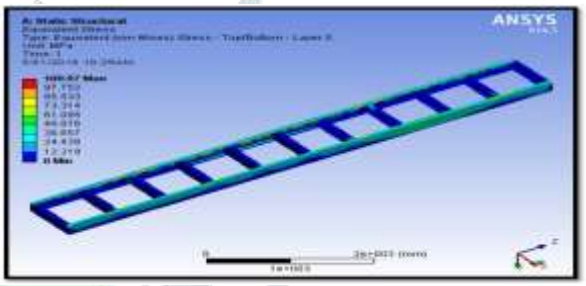

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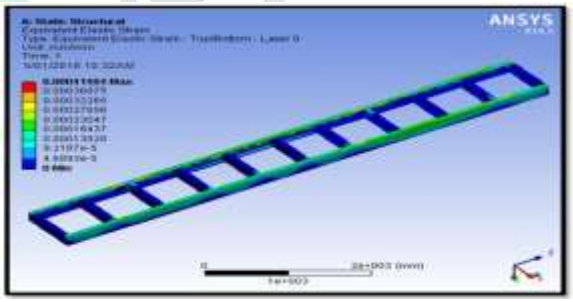
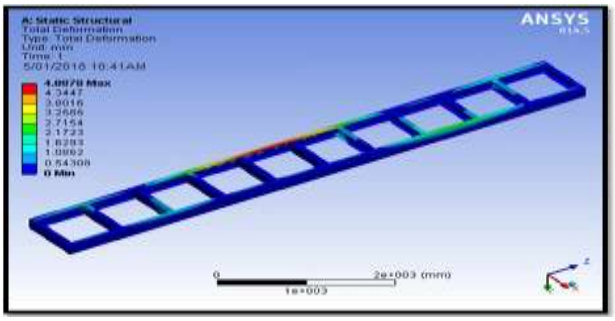


MATERIAL – 997 EPOXY

TOTAL DEFORMATION



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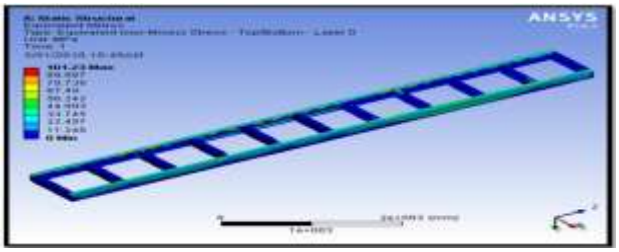
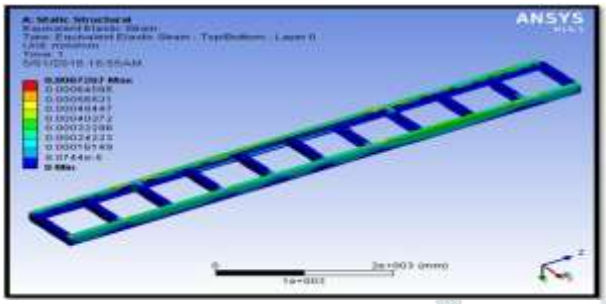


STRAIN



RESULT TABLE

FOR NORMAL MATERIAL
structural analysis

	High carbon steel	Im7 fiber	997 Epoxy
Deformation	0.48671	0.36683	0.67518
Stress	75.336	68.522	65.067
Strain	0.00032472	0.00025161	0.00045458

MODAL ANALYSIS

		High carbon steel	Im7 fiber	997 Epoxy
Mode 1	Deformation	11.6	24.719	26.247
	Frequency	282.63	665.47	502.8
Mode 2	Deformation	11.613	24.75	26.277
	Frequency	282.63	665.48	502.81
Mode 3	Deformation	9.7029	20.623	21.978
	Frequency	288.68	680.29	513.52

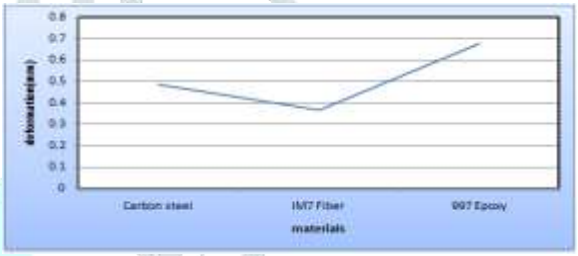
FOR 3 LAYERS
STRUCTURAL ANALYSIS

	High carbon steel	Im7 fiber	997 Epoxy
Deformation	3.3476	2.7751	4.8878
Stress	112.11	109.97	101.23
Strain	0.00049654	0.00041484	0.0007267

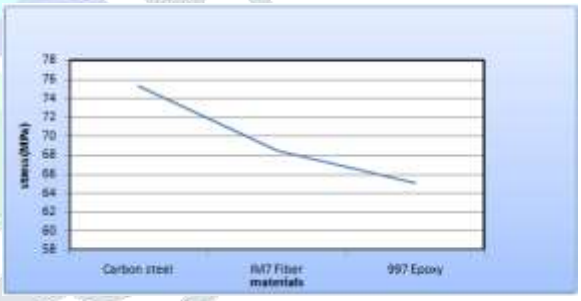
MODEL ANALYSIS

		High carbon steel	Im7 fiber	997 Epoxy
Mode 1	Deformation	10.908	23.552	24.6992
	Frequency	56.499	133.69	100.52
Mode 2	Deformation	10.537	22.785	23.877
	Frequency	67.702	147.82	111.56
Mode 3	Deformation	10.39	22.193	23.544
	Frequency	70.522	165.96	125.48

GRAPHS Structural analysis Normal material adding
DEFORMATION PLOT



STRESS PLOT



CONCLUSION

Presently metal is used for chassis. In this task it's miles changed with the use of materials IM7 Fiber and 997 Epoxy. Structural and Modal analysis is achieved on the chassis for stable and the usage of layer stacking approach.

By watching structural evaluation results the strain values for 997 Epoxy and IM7 fiber are much less than their respectively allowable stress values so using composites for chassis is secure. By the usage of composites instead of steel, the weight of the chassis reduce 4 times than via the use of metallic due to the fact density of metallic is greater than the composites. The strain values are less for 997 epoxy. Also through looking at Modal analysis consequences for all materials, the deformation and frequencies are growing for composites than High Carbon Steel. So vibrations might be increasing if composites are used.

We have additionally carried out layer stacking method (i.E.) by way of taking 3 layers and five layers for equal thickness of principal channel. We have determined that vibrations can be reduced through taking range of layers than by means of taking as a unmarried layer.

So we can conclude that the usage of 997 epoxy is higher.

SCOPES

There is a high scope for further research in chassis simulation to solve vibration, frequency response and mode shape analysis related problems. This chassis structure should be further analyzed and improved on the overall performance especially on structural dynamic behavior and quality auditing for better refinement. Based on these factors, the overall recommendation is to study the structural analysis and should be covered on the overall truck system and after that focus on the specific area such as chassis. This analysis will help to make full body refinement and improvement because it can be related to actual running condition.

BIBILOGRAPHY

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