

# Modelling and Analysis of Heavy Vehicle Chassis For Composite Materials For Hefty Load Circumstances

**HARISH HARSURKAR**

Assistant professor, Dept of Mechanical, AVN  
Institute of Engineering & Technology, Hyderabad,  
T.S., India.

**G SRIKANTH REDDY**

Assistant professor, Dept of Mechanical, AVN  
Institute of Engineering & Technology, Hyderabad,  
T.S., India.

**SADHU PRASHANTH RAJ**

M. Tech student, Dept of Mechanical Engineering, AVN Institute of Engineering & Technology, Hyderabad,  
T.S., India.

**Abstract:** The composite cloth is a cloth composed of or more excellent stages and having bulk homes considerably great from the ones of any of the components. Different sorts of composite material are to be had and in fact, considered one of its far polymer matrix composites. It can be very well-known due to their low rate and smooth fabrication strategies. It has the advantages of immoderate tensile energy, excessive stiffness, and particular corrosion resistance and so on. A gift, this polymer matrix composite fabric is implemented in aerospace, vehicle industries because of its miles the immoderate energy to low weight ration. For cars, chassis includes an assembly of all the essential factors of a truck to be prepared for operation on the street. In our mission, format, and model the heavy vehicle chassis with the useful aid of the use of seasoned/engineer software program software, through taking the information from the l & t heavy car version by using the use of opposite engineering techniques. Presently used the material for chassis is metallic. The critical motive is to replace the chassis cloth with im 7 fiber & 997 epoxy. By using metallic, the weight of the chassis is more in assessment with im 7 fiber & 997 epoxy, due to the fact its density is greater. Structural and modal assessment is finished on chassis for optimizing the above parameters beneath the 10tons load. And we're using layer stacking approach for 3 and five layers for evaluation of im 7 fiber & 997 epoxy.

**Keywords:** IM 7Fiber; 997 Epoxy; Heavy Vehicle Chassis; Hefty Load; Density; ANSYS;

## 1. INTRODUCTION:

Automotive chassis is a French word that grows to be to begin with used to represent the smooth shape. It is a skeletal body on which numerous mechanical elements just like the engine, tires, axle assemblies, brakes, guidance and loads of others. Are bolted. It gives power and balance to the automobile in remarkable conditions. At the time of manufacturing, the frame of an automobile is flexibly melded constant with the form of chassis. Automobile chassis is ordinary they made from moderate sheet steel or composite plastics. It gives the electricity wanted for supporting vehicular components and payload placed upon it. Automotive chassis or automobile chassis allows protective a vehicle rigid, stiff and unbending. It ensures low levels of noise, vibrations, and harshness at a few degrees within the vehicle. The appearing method the body is flexibly bolted to the chassis. This aggregate of the frame and body plays a selection of capabilities. It absorbs the reactions from the actions of the engine and axle, gets there movement forces of the wheels in acceleration and braking, absorbs aerodynamic wind forces and street shocks thru the suspension, and absorbs the important power of impact in the occasion of a twist of destiny. There has been a sluggish shift in present day-day small car designs. There has been a fashion in the course of mixing the chassis body and the body right into an unmarried structural

element. In this grouping, the steel body shell is bolstered with braces that make it rigid sufficient to stand as plenty as the forces which is probably finished to it. To gather higher noise-isolation developments, separate frames are used for unique automobiles. The presence of heavier-gauge steel components in cutting-edge separate frame designs moreover has a dishonest to restrict intrusion in injuries. Automobile chassis without the wheels and one-of-a-kind engine components is known as a frame. Automobile frames provide power and versatility to the automobile. The spine of any car, it is the assisting frame to which the body of an engine, axle assemblies are affixed. Tie bars which might be probable vital components of automobile frames are fasteners that bind one-of-a-type vehicle elements together. Automotive frames are basically a manufactured from metallic. Aluminum is each other uncooked cloth that has more and more growing to be well-known for producing the nice's automobile frames. In an automobile, the front body is difficult and speedy of metal additives that form the framework which moreover enables the front wheels.

## 2. RELATED STUDY:

If feasible, one of the excellent strategies to beautify upon a layout is to make sure that the most appropriate substances are getting used. Steel, as an example, is to be had in diverse grades, and

rebuilding a chassis the use of a higher grade will deliver electricity beats - In drag racing, the chassis of a competing automobile want to be crafted from a minimum grade of metallic in case you need to run make certain commands. Another suitable instance of this is in tubing; the most inexpensive manner to make tubing is to take a flat sheet of metallic, roll it into shape, after which weld the seam (such tubes are referred to as electrically powered resistance welded, or ERW- the picture on the left indicates a tool used to try this on an agency scale). However, this seam may be an inclined thing, and so extruding out a tube in an unmarried (seamless) piece is most well-known. Given that maximum of the time, an area-body chassis is built for a specialized-reason, seamless tubing is probably used, and this is more relevant even as constructing greater additives which consist of roll cages. A vehicle without a body is known as Chassis. The additives of the auto like Power plant, Transmission System, Axles, Wheels and tire, Suspension, Control-ling Systems like Braking, Steering and so on., and moreover electric machine factors are set up at the Chassis frame. It is the main mounting for all the components collectively with the frame. So it's also called as Carrying Unit. In this shape of chassis, the frame is made as a separate unit and then joined with ladder frame. It allows all the systems in a vehicle which incorporates the Engine, Transmission device, Steering tool, Suspension tool.



**Fig.2.1. Conventional chassis or frame-full chassis.**

### 3. DESIGN AND METHODOLOGY:

CAD is a critical commercial enterprise artwork appreciably used in plenty of programs, inclusive of automobile, shipbuilding, and aerospace industries, enterprise and architectural format, prosthetics, and lots of more. CAD is also widely used to supply laptop animation for pc pictures in movies, advertising and marketing, and technical manuals. The gift-day ubiquity and power of laptop structures suggest that even perfume bottles and shampoo dispensers are designed the use of strategies exceptional through engineers of the 1960s. Because of its large financial significance, CAD has been a prime using stress for studies in

computational geometry, computer snapshots (each hardware and software program), and discrete differential geometry.



**Fig.3.1. MAIN CHANNEL 3D model.**

Pro/ENGINEER Wildfire is regular in 3-d product design, imparting enterprise-predominant productiveness gear that promote top notch practices in layout at the same time as making sure compliance at the side of your corporation and organisation requirements. Integrated Pro/ENGINEER CAD/CAM/CAE answers permit you to layout quicker than ever on the identical time as maximizing innovation and first rate, in the long run, create brilliant products.



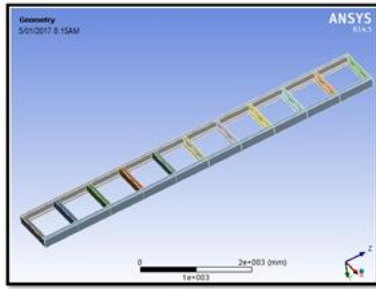
**Fig.3.2. SUPPORT CHANNEL.**



**Fig.3.3. ASSEMBLY model.**

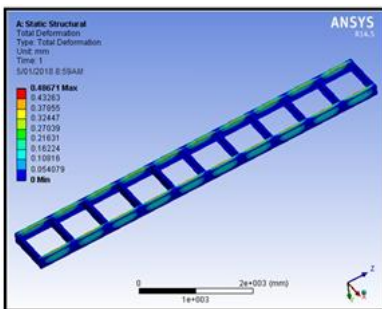
### 4. ANALYSIS RESULTS:

Finite Element Method (FEM) is likewise referred to as Finite Element Analysis (FEA). Finite Element Method is a fundamental assessment method for resolving and substituting complex troubles with the aid of less difficult ones, obtaining approximate solutions Finite element method being a bendy device is applied in several industries to remedy numerous realistic engineering troubles. In finite detail method, it's far viable to generate the relative results.



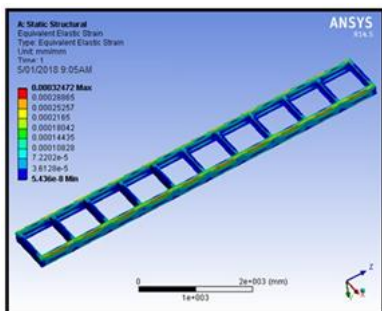
**Fig.4.1. model diagram in ANSYS.**

ANSYS Mechanical is a finite detail assessment device for structural assessment, together with linear, nonlinear and dynamic research. This computer simulation product offers finite factors to version behavior and permits cloth models and equation solvers for an intensive fashion of mechanical layout issues. ANSYS Mechanical furthermore includes thermal evaluation and coupled-physics skills concerning acoustics, piezoelectric, thermal-structural and thermo-electric powered assessment.

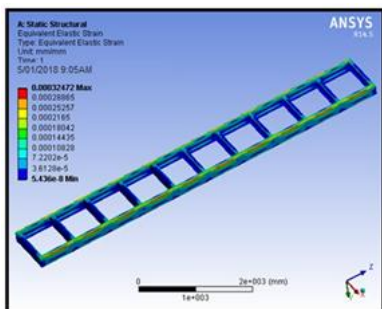


**Fig.4.2. Total deformation model.**

**CARBON STEEL:**

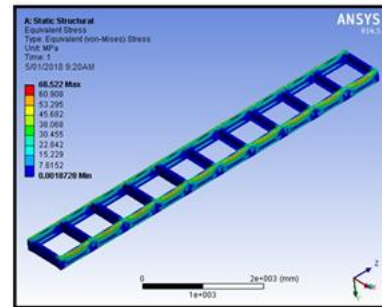


**Fig.4.3. VON-MISES STRAIN.**

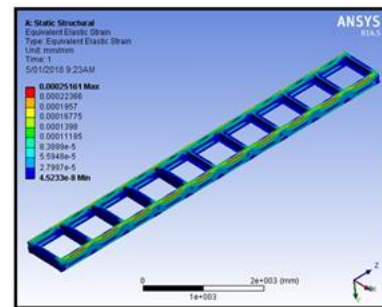


**Fig.4.4. Stress.**

**MATERIAL-IM7 FIBER:**



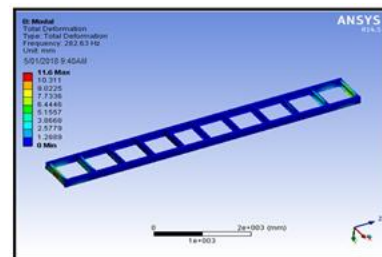
**Fig.4.5. VON-MISES STRESS.**



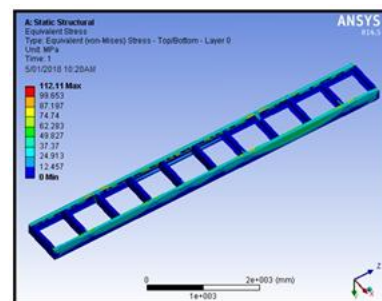
**Fig.4.6. VON-MISES STRAIN.**

**LAYER STACKING 3 LAYERS STRUCTURAL ANALYSIS:**

**MATERIAL - CARBON STEEL:**



**Fig.4.7. Total deformation model.**



**Fig.4.8. Stress in CARBON STEEL.**

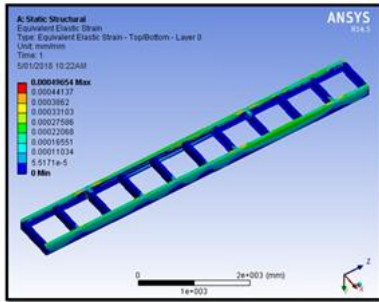


Fig.4.9. Strain at carbon steel.

**LAYER STACKING 5 LAYERS STRUCTURAL ANALYSIS:**

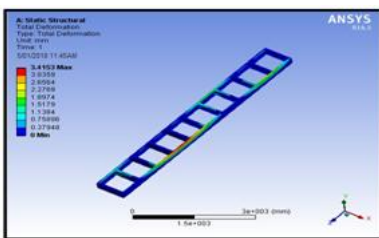


Fig.4.10. Total deformation model.

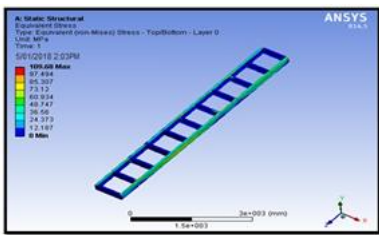


Fig.4.11. Stress.

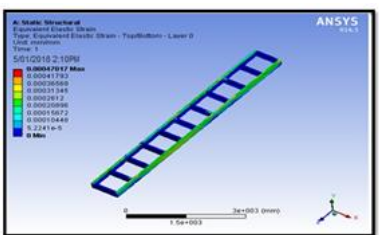


Fig.4.12. Strain.

	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

Fig.4.13. Structural Results.

	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

Fig.4.14. FOR 3 LAYERS STRUCTURAL ANALYSIS.

	High carbon steel	Im7 fiber	997 Epoxy
Deformation	3.4153	2.7998	5.032
Stress	109.68	106.76	99.71
Strain	0.00047017	0.00038594	0.00069272

Fig.4.15. FOR 5 LAYERS STRUCTURAL ANALYSIS.

**5. CONCLUSION:**

Presently steel is used for chassis. In this project, it is modified with using materials IM7 Fiber and 997 Epoxy. The structural and Modal evaluation is achieved at the chassis for strong and the usage of layer stacking method. By searching at structural evaluation results the stress values for 997 Epoxy and IM7 fiber are heaps much less than their respectively allowable pressure values so the use of composites for chassis is at ease. By using composites in preference to metal, the weight of the chassis lessens 4 times than thru using metallic because of the truth density of metallic is extra than the composites. The stress values are a lot much less for 997 epoxy. Also via searching at Modal assessment outcomes for all substances, the deformation and frequencies are developing for composites than High Carbon Steel. So vibrations are probably improved if composites are used. We have moreover carried out layer stacking technique (i.e.) thru manner of taking 3 layers and 5 layers for the identical thickness as the most vital channel. We have determined that vibrations may be reduced with the aid of taking a diffusion of layers than thru taking as a single layer.

**REFERENCES:**

- [1] NitinTenguriaet.Al.“Design and Finite Element Analysis of Horizontal Axis Wind Turbine blade” International Journal of Applied Engineering Research, Dindigul Volume 1, No 3, 2010 ISSN 09764259.
- [2] Mr. Jesus Vega Fuentes,et.Al. “Design of wind turbine blades of an energy of a thousand watts for home use.” 978-1-61284-1325-5/12, 2012 IEEE.

- [3] Mr.V. DíazCasás, et.Al. “Automatic Design and Optimization of Wind Turbine Blades” International Conference on Computational Intelligence for Modelling Control and Automation, and International Conference on Intelligent Agents, Web Technologies and Internet Commerce 0-7695- 2731-zero/06, IEEE.
- [4] Arvind Singh Rathore et al., “Design and Analysis of Horizontal Axis Wind Turbine Rotor”., International Journal of Engineering Science and Technology (IJEST) Vol. Three No.Martinmas 2011 ISSN : 0975-5462.
- [5] Jialin Zhang, et.Al. “Design and Research of HighPerformance Low-Speed Wind Turbine Blades. “November 2011.IEEE.
- [6] Sairam Kotari, V.Gopinath, "Static and dynamic analysis on Tatra chassis" International Journal of Modern Engineering Research (IJMER), Vol.2, Issue.1, pp-086-094.
- [7] K.W. Poh, P.H. Dayawansa, A.W. Dickerson, I.R. Thomas, Steel membrane floors for our bodies of massive rear-promote off mining cars, Finite Elements in Analysis and Design 32, (1999), 141-161.