Modeling And Analysis of An Innova Car Chassis Frame by Varying Cross Section

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ABSTRACT:-

In modern era auto mobile chassis is in important load barring member and it plays an important role of seating an auto mobile body. In present case an analysis is going to be performed on an existing model of an INNOVA 2.5V car chassis model.

Initially drawings will be taken for all views by using reverse engineering concepts, then by using those drawing model will be developed by using latest modeling software's like PRO-E , for draw the INNOVA CAR CHASSIS FRAME with Two different cross section namely Rectangular and C-type models, then model will be saved in IGES format, and same will be imported into FEA software like ANSYS, Static analysis can be performed at loads and boundary conditions will be applied as per technical and practical conditions and then results will be reviewed and submitted.

1.INTRODUCTION:-

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 frames are basically manufactured from steel. Aluminum is another raw material that has increasingly become popular for manufacturing these auto frames. In an automobile, front frame is a set of metal parts that forms the framework which also supports the front wheels. It provides strength needed for supporting vehicular components and payload placed upon it.

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 ,auto motive 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 component 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 auto mobile. The different types of automobile chassis include:

Ladder Chassis: Ladder chassis is considered to be one of the oldest forms of automotive chassis or Auto mobile chassis that is still used by most of the SUVs till today. As its name connotes, ladder c Resembles a shape of a ladder having two longitudinal rails inter linked by several lateral and cross braces.

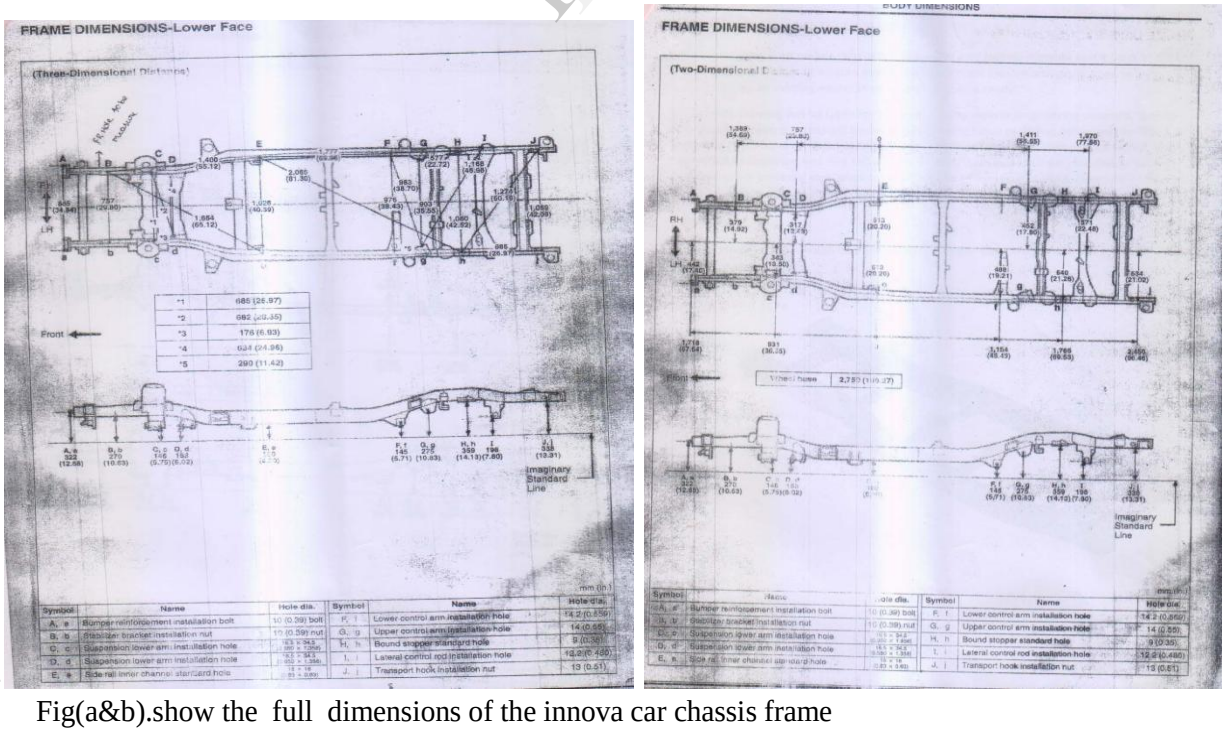
Monocoque Chassis: Monocoque Chassis is a one-piece structure that prescribes the overall shape of a vehicle. This type of automotive chassis is manufactured by welding floor pan and other pieces together. Since monocoque chassis is cost effective and suitable for robotized production, most of the vehicles today make use of steel plated monocoque chassis.

Backbone Chassis: Backbone chassis has a rectangular tube like backbone, usually made up of glass fibre that is used for joining front and rear axle together. This type of automotive chassis or automobile chassis is strong and powerful enough to provide support smaller sports car. Backbone chassis is easy to make and cost effective.

2.SPECIFICATION OF THE PROBLEM:-

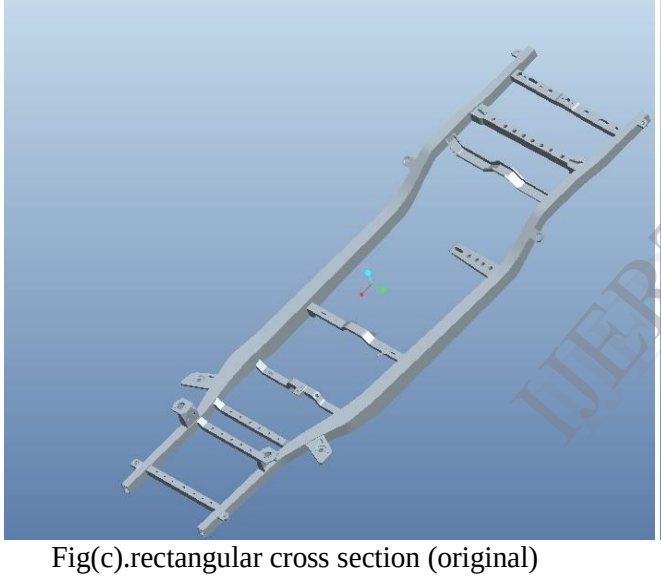
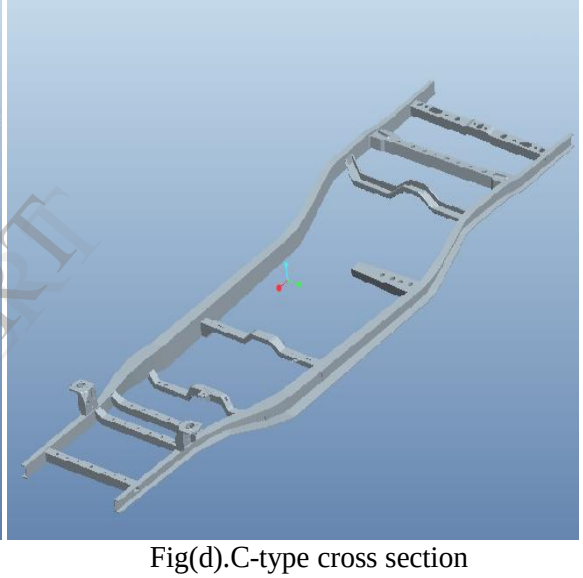
The objective of the present work is to design and analyses, of steel chassis frame with two different cross sections. The chassis was created in Pro-E. Model is imported in ANSYS and we perform the Static Analysis.

3.SPECIFICATION AND PRO-E MODELS OF EXISTING INNOVA CAR VEHICLE CHASSIS:-



Fig(a&b).show the full dimensions of the innova car chassis frame


Fig(c&d).shows the real model of innova car chassis frame

Fig(c).rectangular cross section (original) Fig(d).C-type cross section

4.STRUCTURAL ANALYSIS OF HEAVY VEHICLE CHASSIS:

Dimensions of heavy vehicle chassis are taken as that of the conventional steel.
a 3-D model of chassis is used for analysis in ANSYS. The loading conditions are assumed to be static .

The element choosen is SOLID186 is a higher order 3-D 20-node solid element that exhibits quadratic displacement behavior. The element is defined by 20 nodes having three degrees of freedom per node: translations in the nodal x, y, and z directions. The element supports plasticity, hyperelasticity, creep, stress stiffening, large deflection, and large strain capabilities.

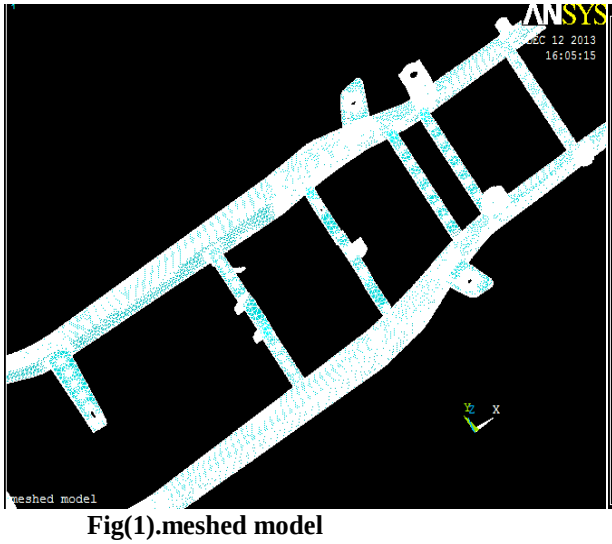
5.BASIC CALCULATION:-

5.1.FOR RECTANGULAR CROSS SECTION:

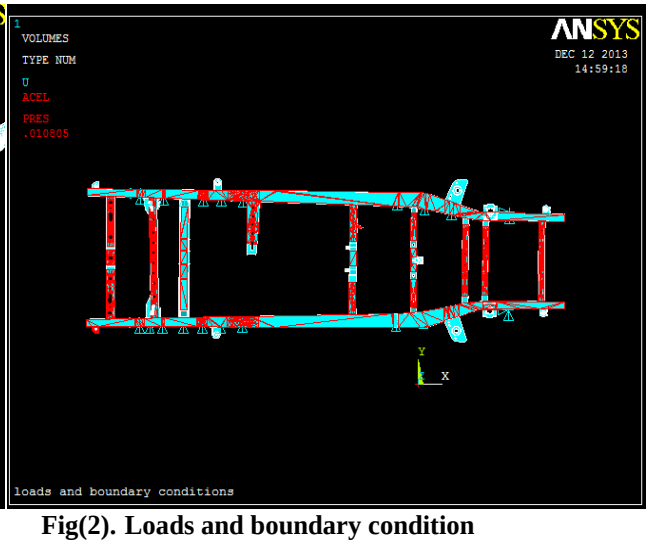
Gross Vehicle weight=1680 kg

The above load (G.V.W) is applied in the form of pressure.
Hence the total area of application of load as calculated from chassis dimensions = 1525175mm2.
Hence the total load to be applied =1680*9.81=16480.8N
Pressure to be applied=16480.8/1525175 =0.0108058Mpa

5.1a.LOAD APPLICATIONS ANDBOUNDARY CONDITIONS:

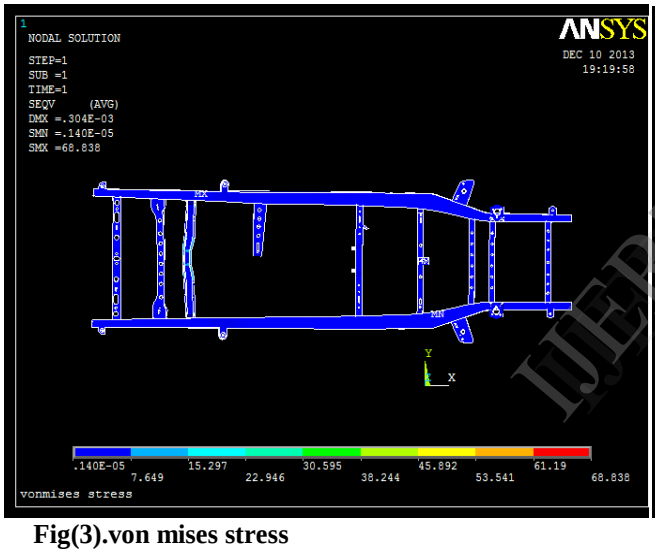


Fig(1).meshed model

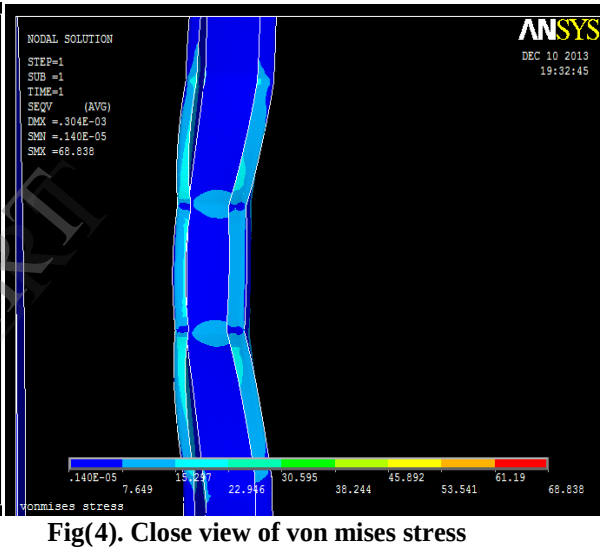


Fig(2). Loads and boundary condition

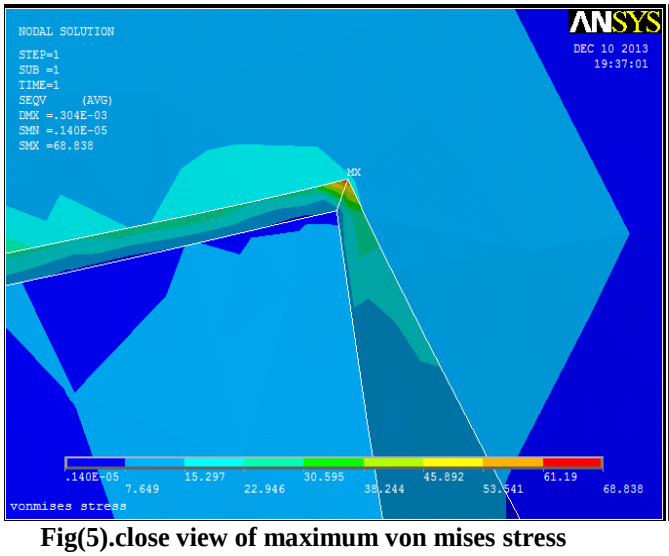
5.1b.RESULTS:-



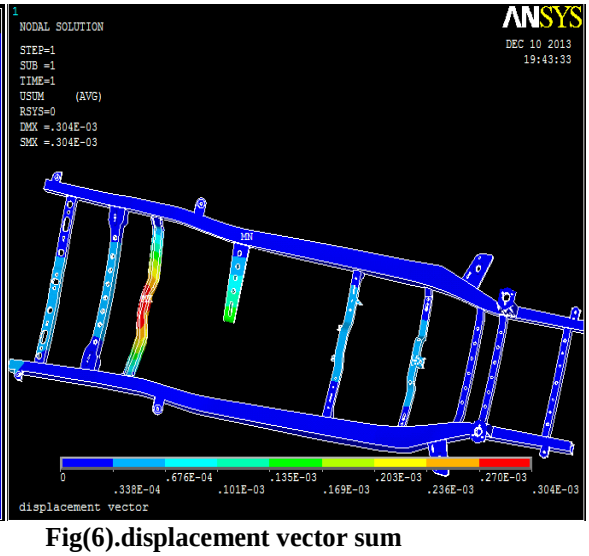
Fig(3).von mises stress



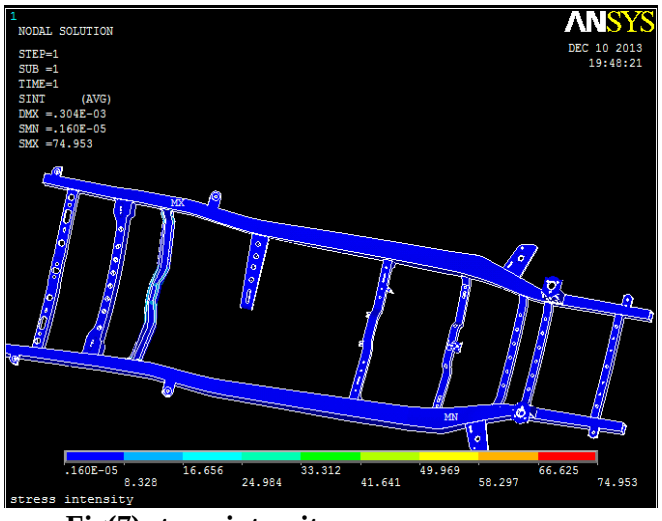
Fig(4). Close view of von mises stress



Fig(5).close view of maximum von mises stress



Fig(6).displacement vector sum

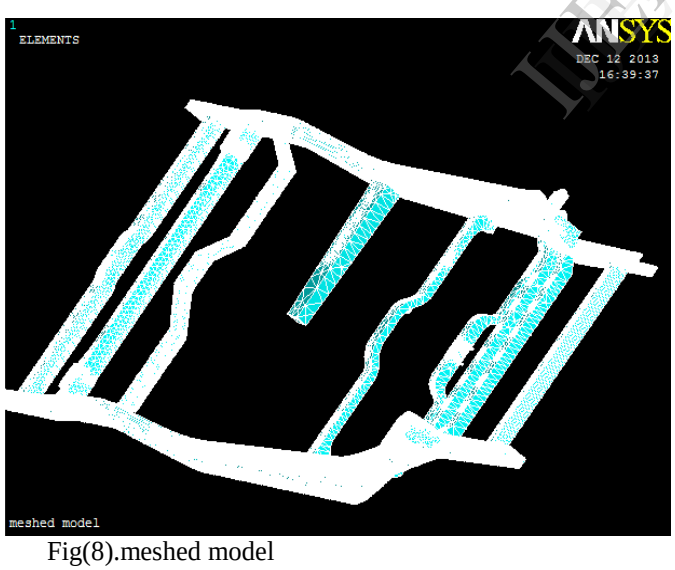


Fig(7).stress intensity

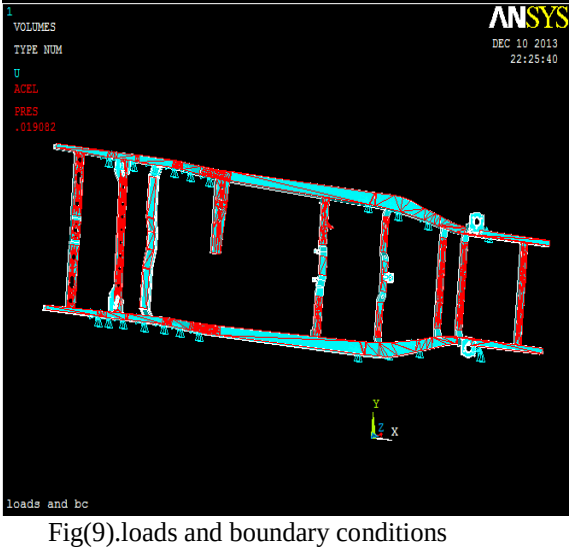
5.2. FOR C-TYPE CROSS SECTION:-

Gross vehicle total weight=1680 kg.
The above load (G.V.W) is applied in the form of pressure.
Hence the total area of application of load as calculated from chassis dimensions = 863674mm2.
Hence the total load to be applied =1680*9.81=16480.8N
Pressure to be applied=16480.8/863674 = 0.019082Mpa

5.2a. LOAD APPLICATIONS ANDBOUNDARY CONDITIONS:-

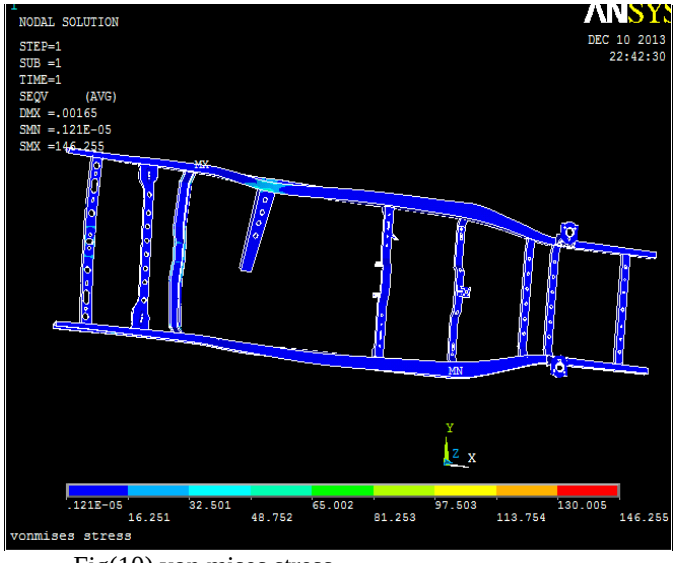


Fig(8).meshed model

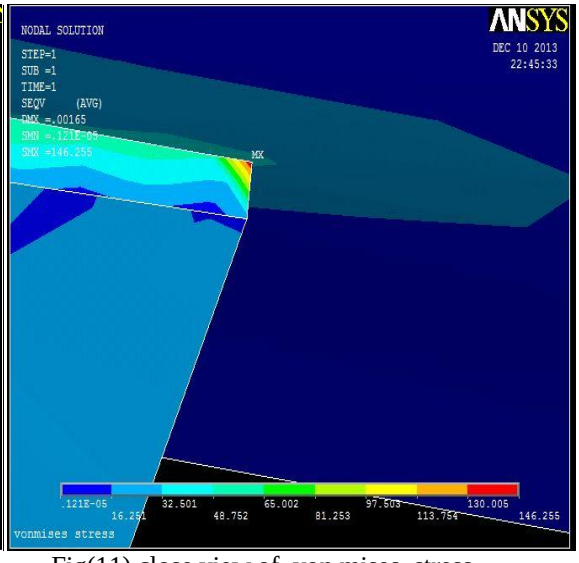


Fig(9).loads and boundary conditions

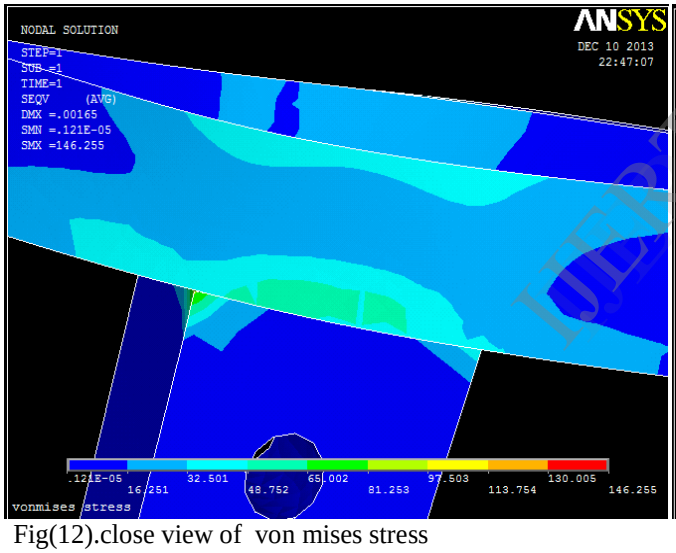
5.2bRESULTS:-



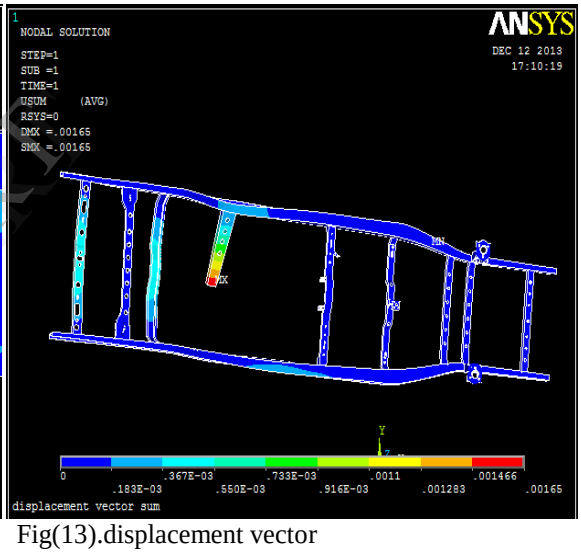
Fig(10).von mises stress



Fig(11).close view of von mises stress



Fig(12).close view of von mises stress



Fig(13).displacement vector

Fig(14).stress intensity

6.RESULTS SUMMERY:-

S.NO	TYPE	STRESS INTENSITY (Mpa)	VON MISES STRESS (Mpa)	TOTAL DEFORMATION (mm)
1.	Rectangular cross Section(original)	74.953	68.838	0.00034
2	C-type cross section	161.156	146.255	0.00165

7.CONCLUSION:-

To observe the all results and to compare the rectangular and c-type cross sectional steel chassis frame from ansys. The rectangular section von mises stress was 68.838N/mm2 and C-section von mises stress was 146.255N/mm2.

C-section stress is higher than the rectangular section ,but it is with in the ultimate strength, so it is usable strength. So that the C-type cross section will reduces the weight ,area, production time and as well as manufacturing cost.

8.REFERENCES:-

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