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Research Paper

ANALYSIS OF CHASSIS WITH & WITHOUT STIFFENER USING FEM

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Automotive Chassis is a skeletal frame which is an Important part of an automobile which should be rigid enough to withstand the shock, twist, vibrations and other stresses. A Stiffener is added to the chassis frame which consist of side members attached with series of cross members to have adequate bending stiffness for better handling characteristics. Design of chassis can be done in the modeling Software CATIA V5 R20 Structural Analysis and Model Analysis will be done on the chassis frame using ANSYS 14.0. This thesis deals with the analysis of chassis frame for improving its payload by adding stiffener.

Keywords: chassis-stresses-modeling-structural analysis- stiffener-pay load

INTRODUCTION

Chassis is a French term and was initially used to denote the frame parts or Basic Structure of the vehicle Chassis is the back bone of the vehicle. A vehicle with out body is called Chassis. The components of the vehicle like Power plant(Engine), Transmission System(gear box), Axles, Wheels and Tires, Suspension System, Controlling System (Braking), Steering etc

TYPES OF CHASSIS FRAMES

There are three types of frames

1. Conventional frame
2. Integral frame
3. Semi-integral frame

Conventional Frame: It has two long side members and 5 to 6 cross members joined together with the help of rivets and bolts. The frame sections are used generally.

a. Channel Section - Good resistance to bending

b. Tabular Section - Good resistance to Torsion

c. Box Section -Good resistance bending and Torsion

Integral Frame: This frame is used now a days in most of the cars. There is no frame and all the assembly units are attached to the body. All the Functions of the frame carried out by the body itself. Due to elimination of long frame it is cheaper and due to less weight most economical also. Only disadvantage is repairing is difficult.

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Semi - Integral Frame: In some vehicles half frame is fixed in the front end on which engine gear box and front suspension is mounted. It has the advantage when the vehicle is met with accident the front frame can be taken easily to replace the damaged chassis frame. This type of frame is used in FIAT cars and some of the European and American cars.

Various loads acting on the chassis frame are

3.1 Short duration Load - While crossing a broken patch.

3.2 Momentary duration Load - While taking a curve.

3.3 Impact Loads - Due to the collision of the vehicle.

3.4 Inertia Load - While applying brakes.

3.5 Static Loads - Loads due to chassis parts.

3.6 Over Loads - Beyond Design capacity.

SPECIFICATIONS OF CHASSIS FRAME

Table 1: Shows Various Parameters of Chassis

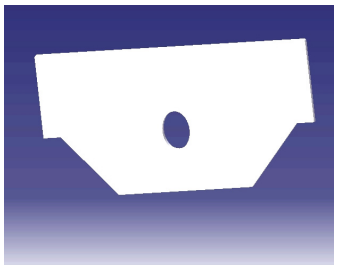
S.No.	Description	Units
1	Length of Chassis	6355 mm
2	Width of Chassis	1000 mm
3	Section	C-section
4	Cabin load	1949.7 N
5	Engine load	3789.3 N

Table 2: Shows Various Parameters of Chassis

S.No.	Property	Value
1	Thickness	12 mm
2	Height	420 mm
3	Width	988 mm
4	Radius	50 mm
5	Angle	1400

The following figure shows the model of the Stiffener.

Figure 1: Stiffener model



FINITE ELEMENT ANALYSIS

Finite element structural analysis is a method of predicting the behavior of a real structure under specified load and displacement conditions. The finite element modeling is generalization of the displacement or matrix method of structural analysis to two and three-dimensional problems and three - dimensional problems. The basic concept of FEM that structure to be analyzed is considered to be an assemblage of discrete pieces called "elements" that are connected together at a finite number of points or nodes. The finite element is a geometrically simplified representation of a small part of the physical structure. Discretising the structure requires experience and complete understanding of the behavior of the structure can behave like a beam, truss, plate, and shell.

Figure 2: Without Stiffener - Boundary Conditions

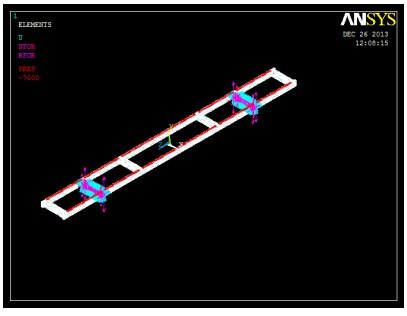


Figure 3: Without Stiffener - Meshing

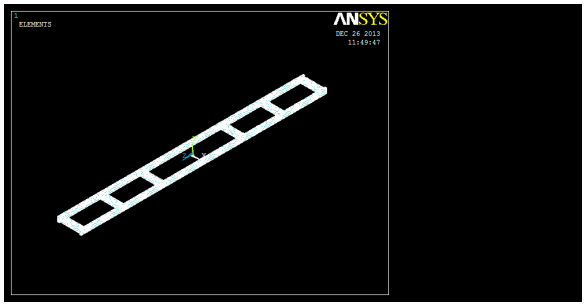


Figure 4: Without Stiffener - Displacement Vector Sum

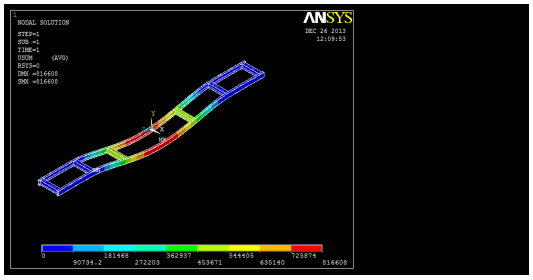


Figure 5: Without Stiffener - Stress Intensity

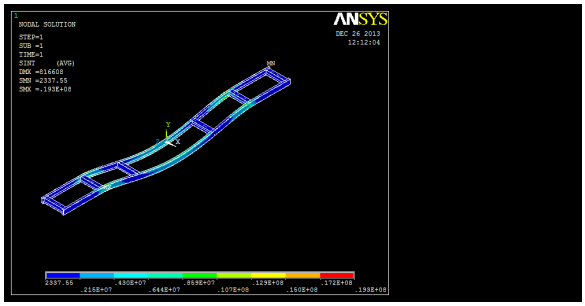


Figure 6: Without Stiffener - Total Mechanical Strain

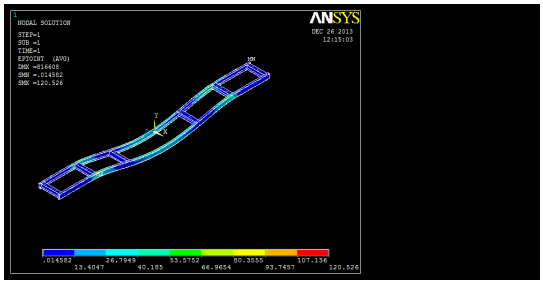


Figure 7: Without Stiffener - Vonmisses Stresses

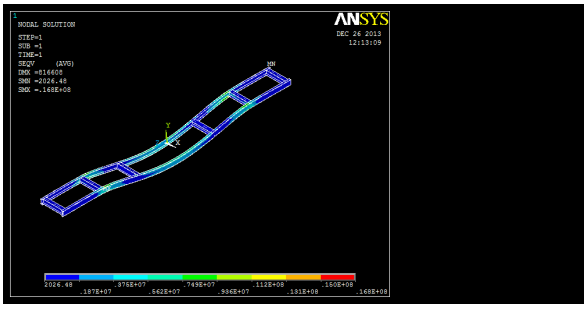


Figure 8: Without Stiffener - Boundary Condition

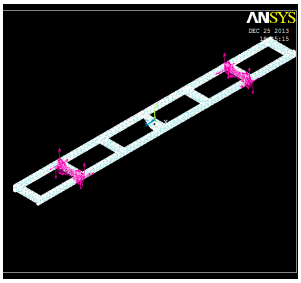


Figure 9: With Stiffener - Meshing

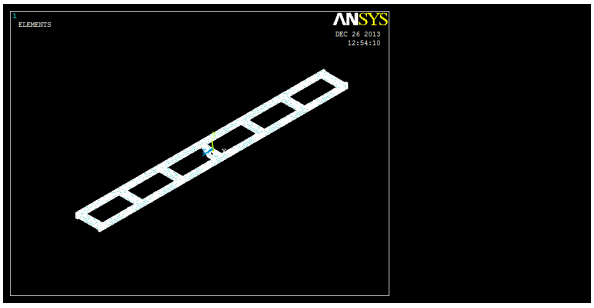


Figure 10: With Stiffener - Displacement Vector Sum

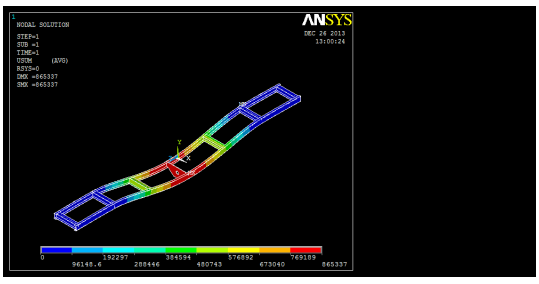


Figure 11: With Stiffener - Stress Intensity

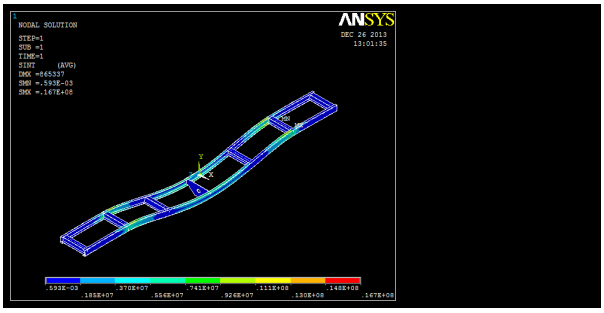


Figure 12: With Stiffener - Total Mechanical Strain

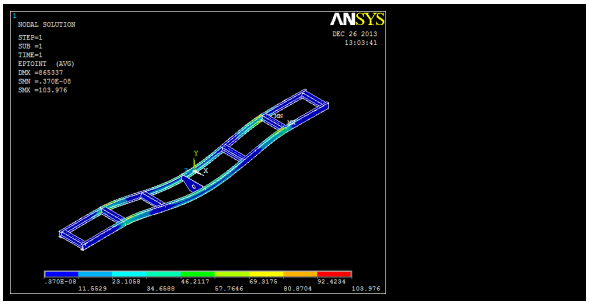
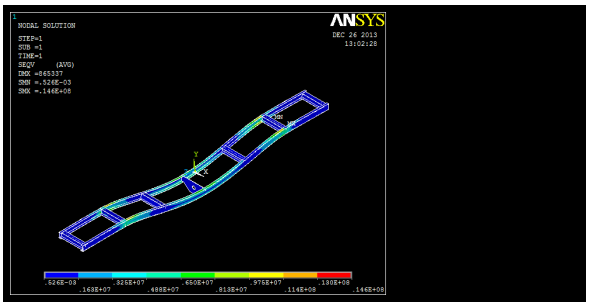


Figure 13: With Stiffener - Vonmisses Stresses



CONCLUSION

The existing chassis was analyzed by the finite element analysis and the stress levels are found.After modifications, the Chassis with addition of stiffeners, the finite element analysis was carried out, From the above Results, it can be concluded that the modified chassis is capable to carry the loads beyond the previous payloads.

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