DESIGN AND ANALYSIS OF HYDRALIC BUMPER FOR SUDDEN IMPACT REDUCTION IN FOUR WHEELERS

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ABSTRACT

To Saving the impact energy in the bumper to be released in the environment reduces the damages of the automobile and passengers. To Reduce the accidents, we are planning to design this project. It may reduce the sudden impact to chassis. Bumpers are used for absorbing the vibrations while dashing. So, we are modulating the bumper assembly with a pair of hydraulic cylinders. In our project oil is given and automatic bumper is moved in front of the vehicle setup with help of pneumatic system. In this project, we have used pneumatic cylinder, oil tank. This project is necessary to be attached to every vehicle.

KEYWORDS*: Bumper, accidents, hydraulic, cylinder, oil*

1.Introduction:

Our mission in this project is to improve the safety designs included in car or four wheel designs. We plan to do this by designing a type of external bumper that expands or compress like an airbag in the case of the car being hit front behind in a collision. It is the project which has been fully equipped and designed for auto vehicles. The technology of hydraulics plays a major role in the field of automation and modern machine shops and space robots. The aim is to design and develop a control system based on intelligent controlled automotive bumper activation system is called "Hydraulic Bumper System"

2. Problem identification:

When accident occurs bumper is subject to impact, if the bumper cannot absorb shock, the shock will be transmitted to car body and passenger and there will be damage to car and risk to life of passenger, when hydraulic cylinder are attached at either end of the bumper, shock will be absorbed and car & passenger are protected.

3. Objective of the project

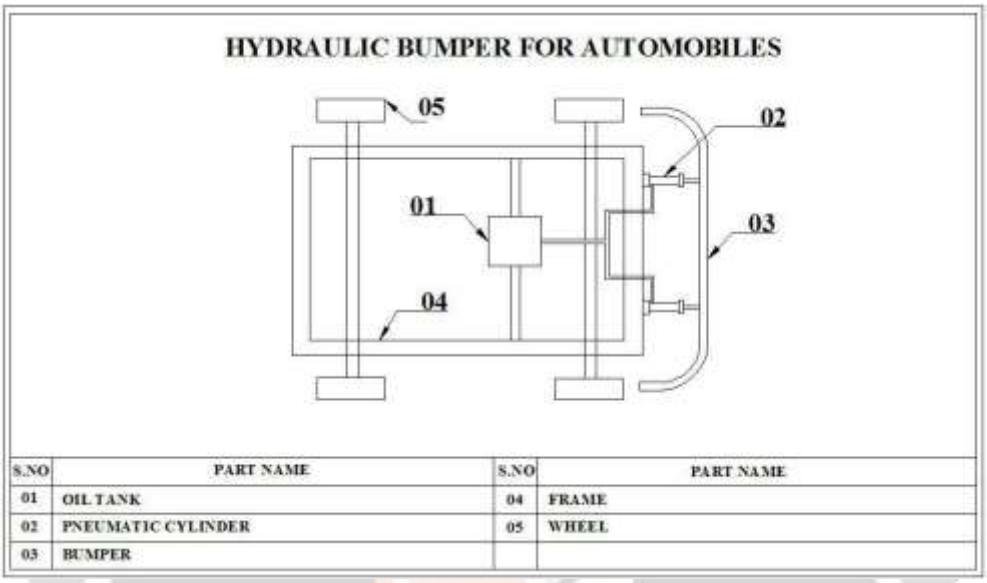
- To absorb the shock during impact on vehicle
- To reduce the damage to vehicle
- To safeguard the passengers from accidents

4.Working principle of the project:

In this project we use pneumatic cylinder to control the bumper. The outlet is closed. The hydraulic oil is filled in the pneumatic cylinder, so the bumper is activated. If any object hit the bumper, it will retract and reduce the shock. After the collision it will extract. the hydraulic oil is used to extract the bumper. The bumper is fixed in front of the vehicle by using the pneumatic cylinder. However, by using this system most of the force will be dissipate by transmitting all the impact energy through the compression of the damper

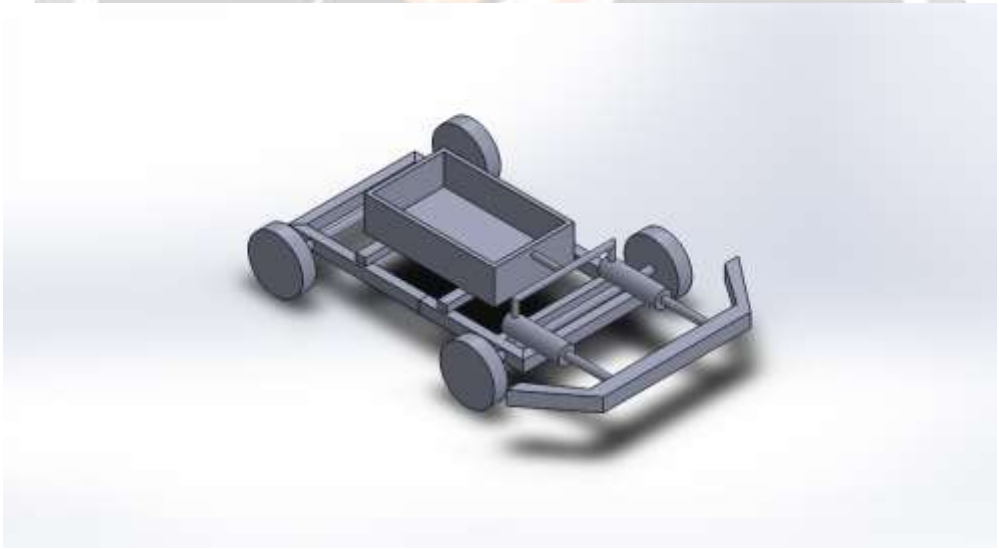
and the remaining force will be transferred to the vehicle chassis. This system normally has very high static damping coefficient and cannot dissipate higher speed collision force. In this project, hydraulic dampers were used to provide dynamic damping coefficient and reduced the crash impact and lowering the transmission of the remaining force to the vehicle body**.**

5. 2d diagram of the project:



S.NO	PART NAME	S.NO	PART NAME
01	OIL TANK	04	FRAME
02	PNEUMATIC CYLINDER	05	WHEEL
03	BUMPER		

5.1 3d diagram:



6. APPROPRIATE ANALYSIS FOR PROJECT:

6.1 STATIC STRUCTURAL ANALYSIS

A static structural analysis determines the displacements, stresses, strains, and forces in structures or components caused by loads that do not induce significant inertia and damping effects. Steady loading and response conditions are assumed; that is, the loads and the structure's response are assumed to vary slowly with respect to time. The types of loading that can be applied in a static analysis include:

- Externally applied forces and pressures
- Steady-state inertial forces (such as gravity or rotational velocity)
- Imposed (nonzero) displacements
- Temperatures (for thermal strain)

6.2 Harmonic response analysis:

Any sustained cyclic load will produce a sustained cyclic response (a harmonic response) in a structural system. Harmonic response analysis gives you the ability to predict the sustained dynamic behavior of your structures, thus enabling you to verify whether your designs will successfully overcome resonance, fatigue, and other harmful effects of forced vibrations.

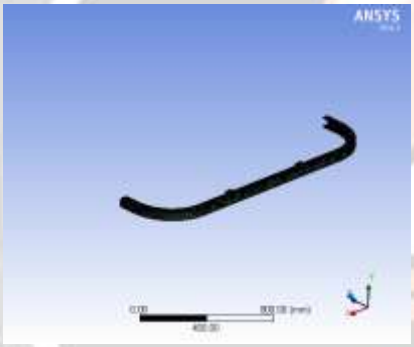
The procedure for a full harmonic response analysis consists of three main steps:

1. Build the model.

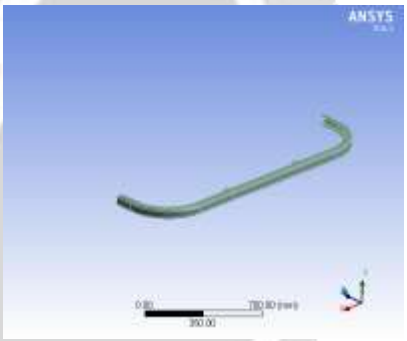
2. Apply loads and obtain the solution.

3. Review the results.

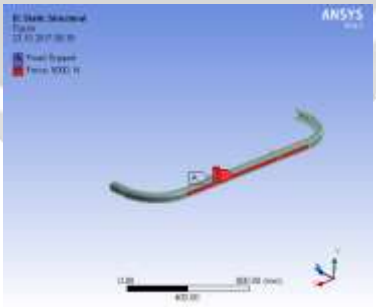
MESH VIEW IN ANSYS WORKBENCH



GEOMETRY VIEW IN ANSYS



LOADS & SUPPPORT APPLIED IN ANSYS WORKBENCH

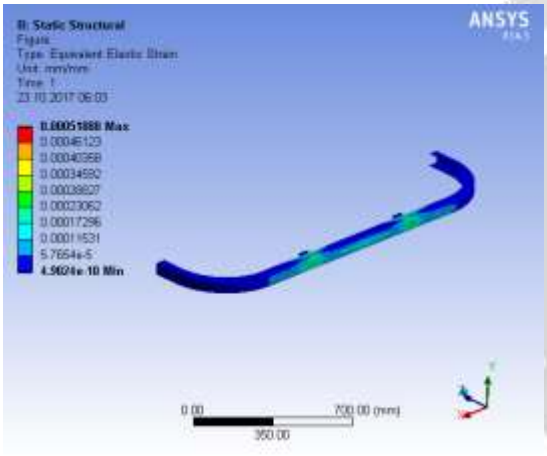


7.Results and discussion:

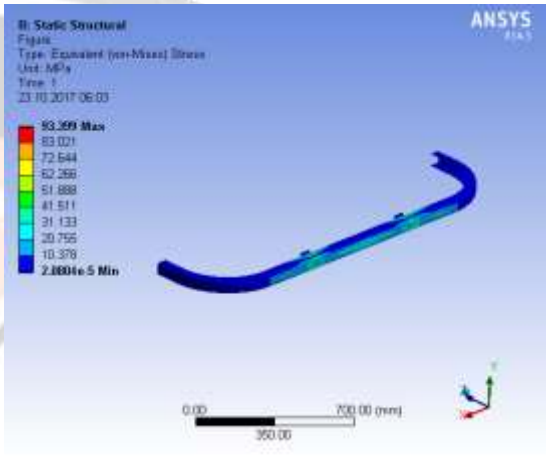
7.1 RESULTS FOR ALUMINIUM ALLOY BUMPER

STRUCTURAL ANALYSIS

EQUIVALENT STRAIN

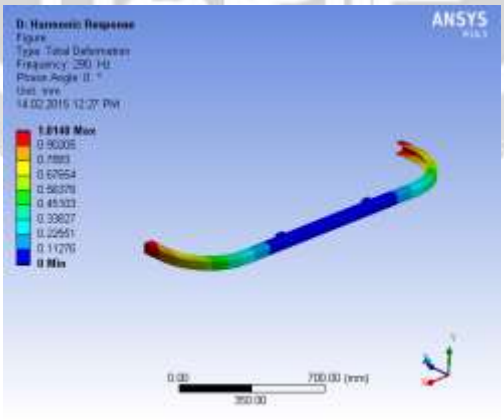


EQUIVALENT STRESS

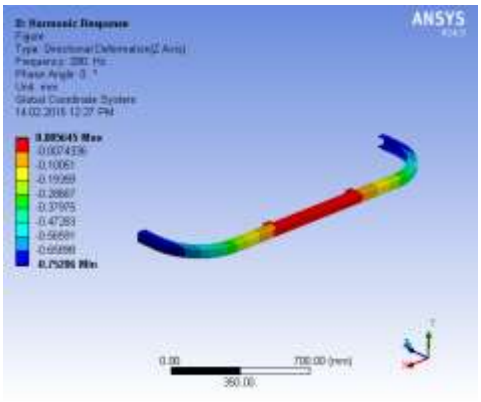


RESULTS FOR BUMPER IN HARMONIC (VIBRATIONAL) ANALYSIS

TOTAL DEFORMATION



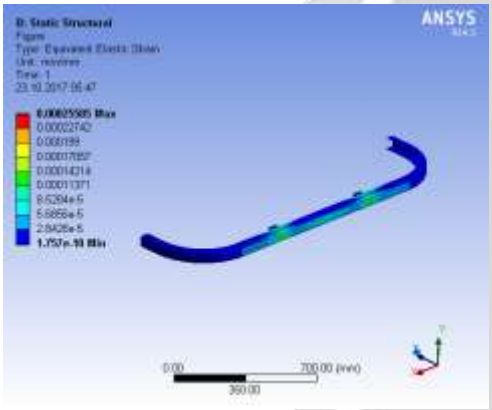
DIRECTIONAL DEFORMATION



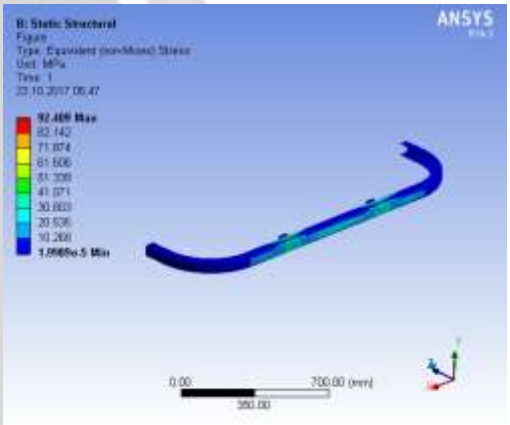
7.2 RESULTS FOR CARBON FIBER COMPOSITE BUMPER

STRUCTURAL ANALYSIS

EQUIVALENT STRAIN

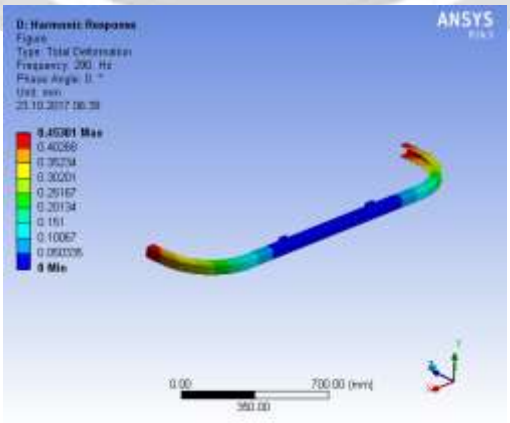


EQUIVALENT STRESS

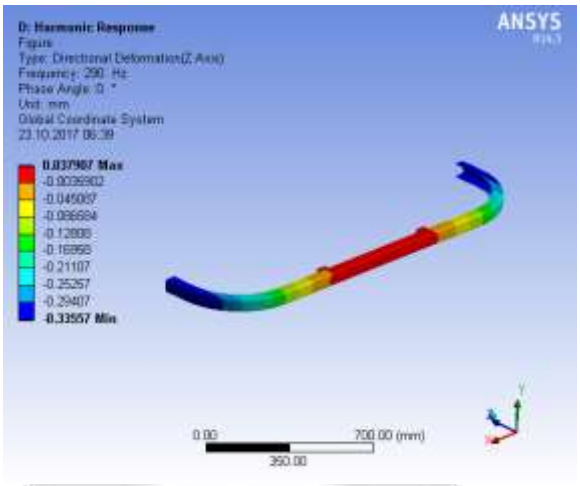


RESULTS FOR BUMPER IN HARMONIC (VIBRATIONAL) ANALYSIS

TOTAL DEFORMATION



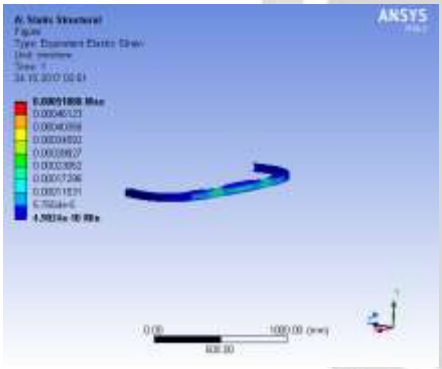
DIRECTIONAL DEFORMATION



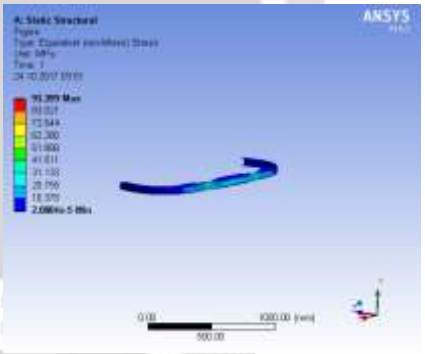
7.3 RESULTS FOR STEEL BUMPER

STRUCTURAL ANALYSIS

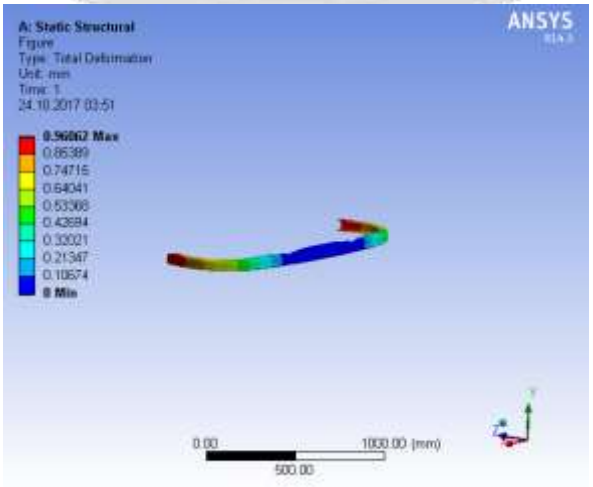
EQUIVALENT STRAIN



EQUIVALENT STRESS



TOTAL DEFORMATION



7.4 RESULTS FOR BUMPER USING STRUCTURAL AND HARMONIC RESPONSE ANALYSIS

ALUMINIUM ALLOY

	MIN	MAX
Equivalent Elastic Strain (mm/mm)	4.9e-10	5.18e-4
Equivalent stress (MPa)	2.08e-5	93.399
Total deformation (mm)	0	1.014
Directional deformation (mm)	-0.75	0.08

CARBON FIBER COMPOSITE

	MIN	MAX
Equivalent Elastic Strain (mm/mm)	1.757e-10	2.558e-4
Equivalent stress (MPa)	1.99e-5	92.409
Total deformation (mm)	0	0.45
Directional deformation (mm)	-0.33	0.037

STEEL

	MIN	MAX
Equivalent Elastic Strain (mm/mm)	4.902e-10	$5.188e^{-10}$
Equivalent stress (MPa)	$2.0804e^{-5}$	93.399
Total deformation (mm)	0	0.96

8.Conclusion:

This project is made with pre-planning, that it provides flexibility in operation. This innovation has made the more desirable and economical. This project "**HYDRAULIC BUMPER FOR AUTOMOBILE**" is designed with the hope that it is very much economical and help full to constructional areas and some industries.

An Analysis results for bumper under force are listed in the Table. Analysis has been carried out by structural and harmonic response analysis for both aluminum alloy and carbon fiber composite materials. The results for static structural such as equivalent elastic strain, and equivalent stress are determined bumper. Then structural inputs are given to the harmonic response analysis via modal analysis to find directional and total deformation. When apply the total load on the bumper, carbon fiber composite bumper has low deformation, stress and strain values compared to aluminum alloy bumper. So we conclude that carbon fiber composite is suitable for bumper.

While carrying out this project we are able to study about the 3Dmodelling software (PRO-E) and Study about the analyzing software (ansys) to develop our basic knowledge IN UNDERSTSNDING about the design.

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