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Modeling and Stress Analysis of Impact Attenuator for Vehicles Protection

[1]YALAGANDALA AKSHAY KUMAR, [2]M. UJWALA, [3]ALLOLI RAJASRI

[1]Assistant Professor Dept of Mechanical Engineering, Anurag Group of Institutions (Formerly CVSR Engineering College), Venkatapur Village, Ghatkesar.

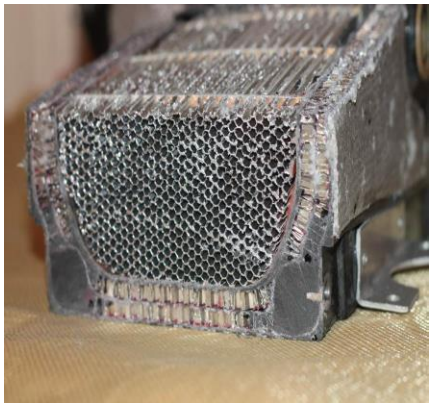
[2]Assistant Professor Dept of Mechanical Engineering, Anurag Group of Institutions (Formerly CVSR Engineering College), Venkatapur Village, Ghatkesar.

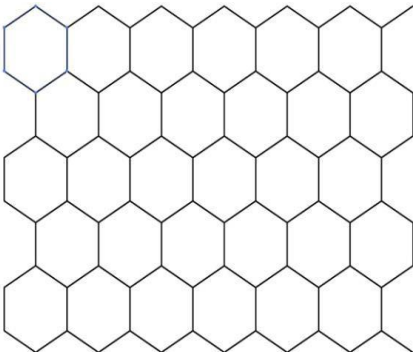
[3]Assistant Professor Dept of Mechanical Engineering, Anurag Group of Institutions (Formerly CVSR Engineering College), Venkatapur Village, Ghatkesar.

ABSTRACT:

In high speed race car having An impact attenuator, also known as a crash cushion, crash attenuator, or cowboy cushion, is a device intended to reduce the damage to structures, vehicles, and motorists resulting from a motor vehicle collision or sudden happen accidents. So In this project Impact attenuators are designed with honeycomb structure to absorb the colliding vehicle's kinetic energy or sudden acted forces.Honeycomb Impact attenuator is a deformable, energy absorbing structure located at the front of the vehicle whose sole purpose is to absorb the kinetic energy of the high speed race car and limit the deceleration acting on the human body. Also discusses the sudden crash analysis of the designed attenuator honey comb structure in order to determine the safety of the design. The design with the help of the computer aided software catia. Dynamic and structural analysis and stress and strain, von misses stress, equivalent stress, total deformation is anlyse with the help of ansys .whereas Initial requirements of used materials are taken advanced carbonfiber reinforced plastic materialsafter completion of the analysis comparison the existing material and new materials of honey comb stracture.

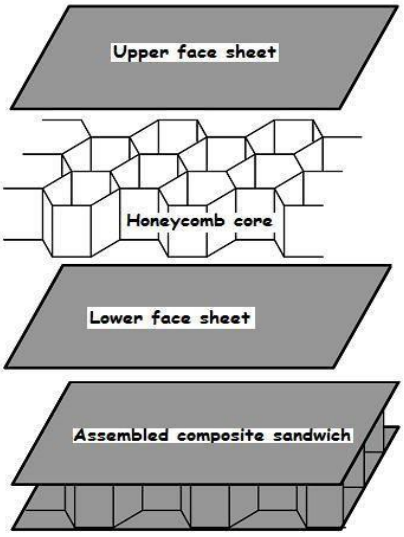
Keywords: Design, Impact attenuator, dynamic structural analysis, Honeycomb stracture, catia v5, ansys.





INTRODUCTION:-

➢ The most important part of the aeronautical structures, the helicopter main rotor blade, can use exclusively composite materials. The most frequent solution is that of the sandwich structure with a core made of a very light material, in which the external surfaces have high strength limit. One of the most frequently used structures for the core is the honeycomb structure. Therefore, this paper present the applications of the finite element method for the determination of the elastic characteristics of the sandwich structure made of Dural boards and honeycomb core. In figure 1, a honeycomb core is presented, the materials used being aluminum, paper or carbon fiber, depending on the pressures to which the sandwich structure is subjected.



➢ Honeycomb structures are natural or man-made structures that have the geometry of a honeycomb to allow the minimization of the amount of used material to reach minimal weight and minimal material cost. The geometry of honeycomb structures can vary widely but the common feature of all such structures is an array of hollow cells formed between thin vertical walls. The cells are often columnar and hexagonal in shape. The standard hexagonal honeycomb is the basic and most common cellular honeycomb configuration.

Geometric types of honeycomb structures:

In geometry, a honeycomb is a space filling or close packing of polyhedral or higher-dimensional cells, so that there are no gaps. The honeycomb sandwich construction is one of the most valued structural engineering innovations developed by the composites industry. Used extensively in aerospace and many other industries, the honeycomb sandwich provides the following key benefits over conventional materials: -

- Very low weight
- High stiffness
- Durability
- Production cost savings

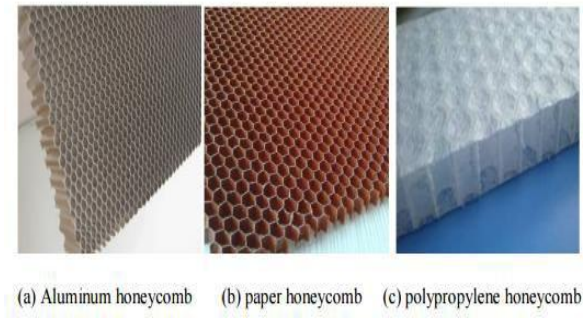
Today, the manufacture of honeycomb cores involves the use of the expansion and corrugation processes where composite materials such as fiberglass, aluminum, and carbon fiber reinforced plastic are used. To manufacture thermoplastic honeycomb cores, the raw material used is polypropylene and the method used is extrusion.

The key benefits of using honeycomb composites are given below:

- Exceptional strength to weight ratio
- Corrosion resistance
- High toughness
- Fire and fungus resistant
- High temperature performance
- Does not absorb moisture
- Easily machinable and formable

LITERATURE REVIEW:

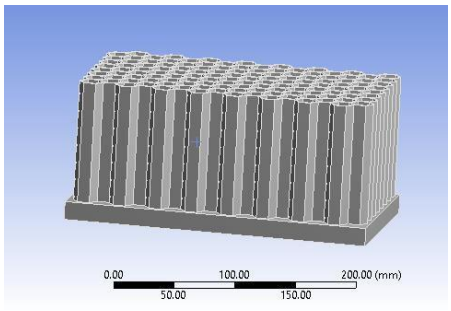
The structures that naturally have the geometry of honeycomb shape are known as honeycomb structures. The minimum amount of materials is used in honeycomb materials. Therefore, the cost of raw materials in honeycomb materials is very low but the manufacturing process has a high effect on the cost of these materials. Different types of materials such as paper, aluminum, steel, composite materials and plastic can be used in fabrication of honeycomb materials. Aluminum honeycomb, polypropylene honeycomb and paper honeycomb are three examples of honeycomb materials.



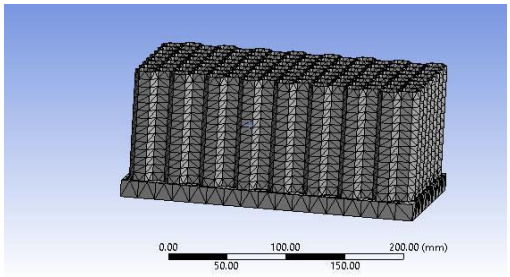
(a) Aluminum honeycomb (b) paper honeycomb (c) polypropylene honeycomb

- Paper honeycomb for structural building panels was evaluated by Seidl, Kuenzi and Fahey. They investigated the effect of the decay, acidity,, alkalinity and aging on the shear and compressive strength of paper cores. The weight percent of the phenolic resin, urea, and sodium silicate adhesives were varied in an attempt to determine optimum proportions of base material (Kraft paper) and adhesive for core manufacturing
- Joel Galos at el have studied in research topic that in road haulage the empty weight of a vehicle is a significant contributor to fuel consumption and resulting CO2 emissions. The application of lightweight materials in design is one avenue that needs to be explored in reducing the carbon footprint of road freight vehicles
- Kuenzi went on to discuss how a series of tests were conducted to assess the structural capability of titanium alloy sandwich construction having the facings and the honeycomb core bonded by diffusion. Results in flatwise tension and compression, edgewise compression and shear tests were presented.

Results:

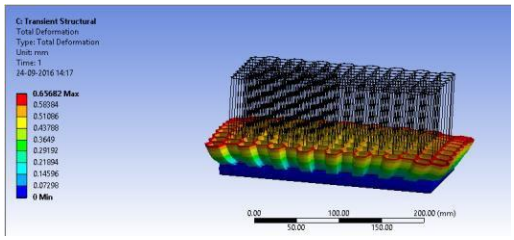


Mesh:

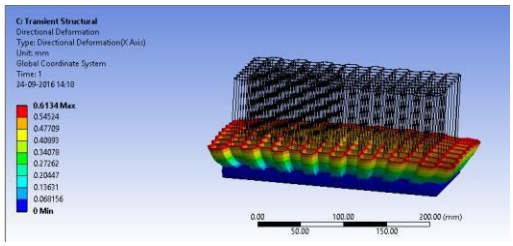


Alluminum ally:

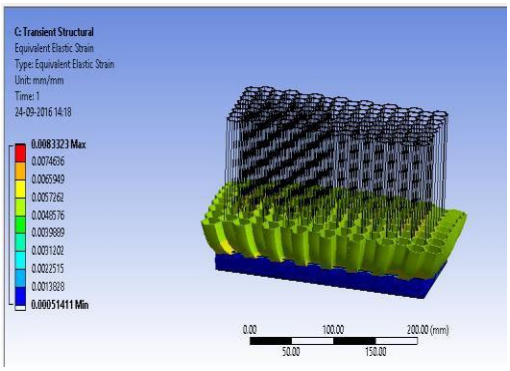
Total deformation



Directional deformation:



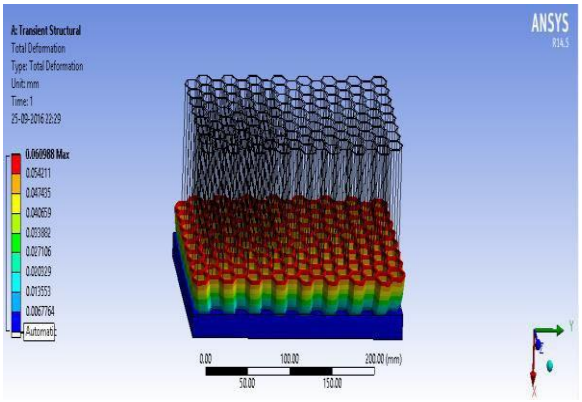
Equivalant elastic strain:



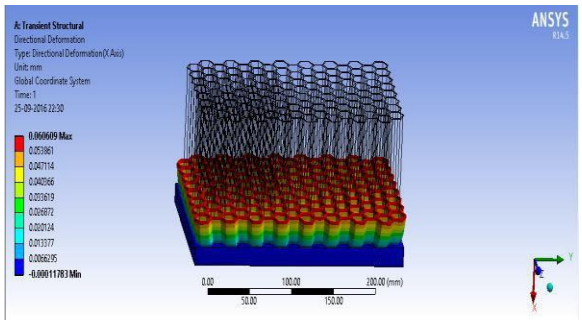
	minimum	maximum
Total deformation	0. mm	0.65682 mm
Directional deformation	0. mm	0.6134 mm
Equivalant elastic strain	5.1411e-004 mm/mm	8.3323e-003 mm/mm

Carbon fiber composite materials:

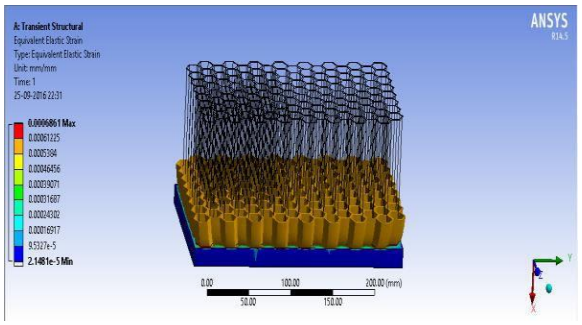
Total deformation:



Directional deformation:



Equivalant elastic strain:



	minimum	maximum
Total deformation	0. mm	6.0988e-002 mm
Directional deformation	-1.1783e-004 mm	6.0609e-002 mm
Equivalant elastic strain	2.1481e-005 mm/mm	6.861e-004 mm/mm

Conclusion:

 From above absarving the above the results carbon fiber is more deformation compar to alluminium alloy

 Mass of carbon fiber material is less then allumium alloy material

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