EXPLICIT DYNAMIC ANALYSIS OF HYBRID REINFORCED COMPOSITE FOR INDUSTRIAL SAFETY HELMET

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ABSTRACT: Recently, the use of fiber developed polymer in each field of planning (vehicle, industry and aeronautics) and clinical has extended due to its indisputable mechanical properties. The fiber based polymer composites are more standard because these have high strength, light in weight, insignificant cost and viably available. In the current work, the limited component examination (FEA) of fiber/epoxy composite based present day security cap has been performed using solid works diversion programming. The exhibiting results show that glass fiber upheld epoxy composite can be used as a material for production of present-day security cap which has extraordinary mechanical properties than the current head defender material. The explicit dynamic analysis is to be done for hybrid reinforced composite materials. These fiber reinforced composites are to be analysed by ANSYS platform to achieve the analytical results.

Keywords: Hybrid Composite, ANSYS, Explicit Dynamic Analysis.

1. INTRODUCTION

A composite material is gotten when no less than two materials are united together to outline another material which has favored properties over the individual one. A composite has generally two sections network and the help. The guideline limit of lattice to move the store to the help and confining the help together and the essential limit of help is to hold the pile. Dependent upon the cross section material, composites are assigned metal structure, polymer matrix, and pottery network composite. Dependent upon the help, composites are particulate composite and fiber composite [1-2]. Fibers are named designed and typical strands. Designed fibers are the man-made strands that are set up by unrefined materials obtained from nature. Designed fibers join glass, carbon, aramid, rayon, nylon, metallic strands, etc The most routinely used fiber is glass fiber which appreciates a couple of advantages like high strength, high engineered check, extraordinary ensuring properties and insignificant cost.

Covers are used to guarantee head by charming impact energy and secure against hurt. Various types of covers that are used to safeguard head from wounds depend on its uses like ballistic covers, bicycle/bicycle defensive covers and mechanical covers. The essential property of a head defender is to hold the impact energy. Close by this property, a prosperity cap should be light in weight and low volume since light in weight and low volume don't make any torture or issue the workers head and neck. V. Kostopoulos et al. [3] investigated the impact hurt response of a composite bicycle prosperity head defender using hydrodynamic restricted part code on LS-DYNA3D programming.

CATIA and ANSYS were used for restricted segment assessment and differentiated the mechanical properties and existing prosperity head defender material which was broadened polystyrene Styrofoam (EPS). The designers derived that made coconut fiber upheld epoxy composite shell would do well to pressure ingestion capacity, eco-obliging in nature and it had insignificant cost when diverged from expanded polystyrene Styrofoam (EPS) . Murali et al. [5] made the cutting edge prosperity cap using jute/banana/sisal fiber upheld epoxy composite by hand layup technique. The designers assumed that the made jute/banana/sisal fiber developed epoxy composite would do well to strength (53.06 J/m) and less weight (252 gm) when stood out from acronytrile butadiene styrene (ABS) which has influence strength of 50J/m and weight 370 gm. Natsa et al. [6] fabricated a strategic head defender using coir fiber upheld epoxy sap composite. Seven models were made having 20%, 40%, half, 60%, 70%, 80% and 85% coir fiber content in the composite and their mechanical properties were investigated. The models having a fiber substance of 70% and 28% sap offered great properties having influence strength of 8.733 J/mm2. Bernd et al [7] investigate the head defender shell made by using carbon fiber. Four unmistakable cap shells was made using same carbon fiber. The amount of fiber layers and fiber configuration was fluctuating. The examination of impact lead of defensive cap shell was performed using the Gaussian bend and the mean recurring pattern procedure in CATIA V5. The 2-wire drop test was showed that two-planned shell with five layers has the best impact direct then other three head defender shells. Satish Gandhi et al. [8] finished the presentation examination of motor cycle cap under static and dynamic stacking. The head defender model was arranged using Pro-E programming and the proliferation was performed using ANSYS programming.

Under different conditions like base fixed weight on top surface, base fixed-load on top line, side fixed-load on reverse surface, side fixed-load on converse line. For static examination the best contorting was 6.2263 mm and most outrageous strain energy was 111.94 joules and for dynamic assessment the supreme disfigurement was 12.147 mm. The makers assumed that conditions as base fixed weight on top surface and side fixed-load on backwards line has gone through less strain energy and misshapening. Alessandro Cernicchi [9] did showing of composite shell of defensive cap using Finite Element Model. The designer investigates the Mechanical properties of composite cap shell using Halpin-Tsai condition. The preliminary outcomes are acceptable when difference and speculative results. In the current work, the reenactment of present-day security cap made of S-Glass/epoxy composite has been finished using the solidworks generation programming.

2. MATERIAL AND METHODS

In the current work, CAD-embedded solidworks variation 12 amusement programming has been used to show mechanical prosperity cap. Material for defensive cap has been taken as S-glass upheld epoxy composite. As the key weight in defensive cap is influence load, the drop test has been recreated in the item environment. Different surfaces of the security cap have been reenacted freely. All of the surfaces were discretized with fine cross section. The reenactment results were differentiated and the outcomes of existing defensive cap material (for instance polypropylene)

In the current work, CAD-implanted solidworks adaptation 12 reenactment programming has been utilized to show mechanical wellbeing head protector. Material for head protector has been taken as S-glass built up epoxy composite. As the principal load in head protector is sway load, the drop test has been recreated in the product climate. Various surfaces of the wellbeing protective cap have been mimicked independently. Every one of the surfaces were discretized with fine cross section. The recreation results were contrasted and the aftereffects of existing protective cap material (for example polypropylene).

Input Information: -
Density = 1115Kg/m^3, Mesh Element Size : 0.001
Youngs Modulus - $\frac{\text{Tensile Strength}}{\text{Tensile Strain}}$ MPa
% Elongation = $\frac{\text{Final Length at Fracture} - \text{Initial Length}}{\text{Intial Length}}$ X 100
Strain = $\frac{\text{Final Length at Fracture} - \text{Initial Length}}{\text{Intial Length}}$
Actual Length = 57 mm, Final legth After Fracture = 62mm
Poisson Ration = 0.3
Velocity of the Hammer – V= $\sqrt{2gh}$ Where g = 9.81
h = 6 m (Distance), V= 10 m/sec
Force – F (According to Drop Test the Helmet get Crack at 14 Kg Load)
So, therefore the force varying with some 19.6N interval [19.6N, 39.22N, 58.83N, 78.48N, 98.12N, 117.7N, 137.34N, 156.96N]

3. RESULT AND DISCUSSION

First, the model of industrial safety helmet shown in figure 3 has been imported to the solidworks simulation software environment. The helmet model is drawn in four surface parts. The protective cap model is attracted four surface parts. In solidworks surface has been chosen and the material of cap as s-glass and entered the properties of s-glass appeared in figure 4. The drop test is performed to break down the modern security protective cap and the cross section component was taken in three-sided structure with network size 4.4472 mm. More modest the cross-section size better the recreation results

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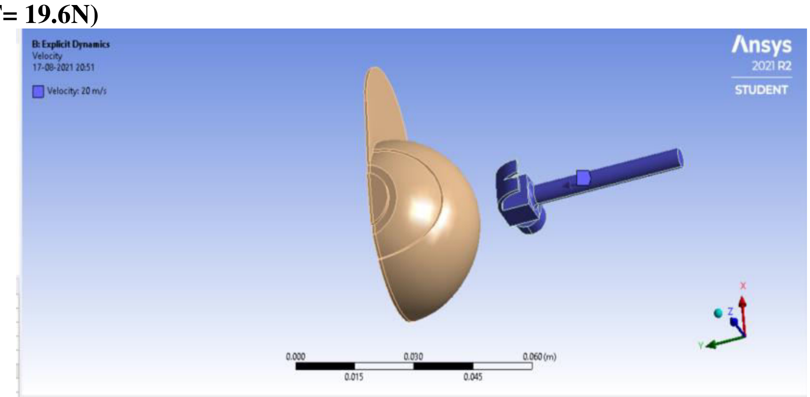
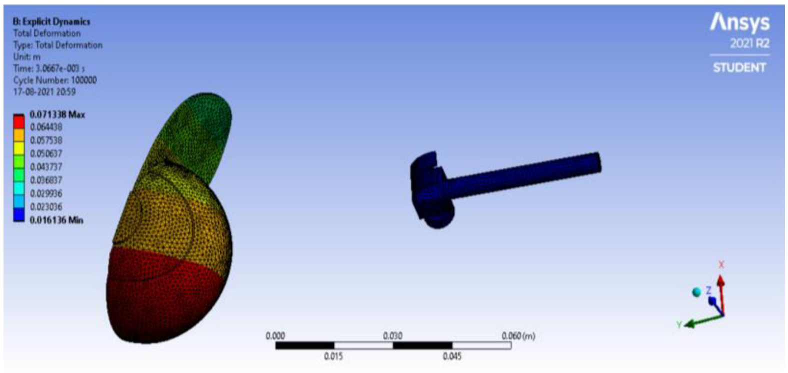
got. The Generated network components, Von-misses stresses and strain created during reproduction are appeared in figure 3, figure 4 and figure separately.

The ANSYS Workbench platform is the backbone for delivering a comprehensive and integrated simulation system. Using Workbench for our product development simulations will result in higher productivity from integrated applications and access to Multiphysics and systems level capabilities.

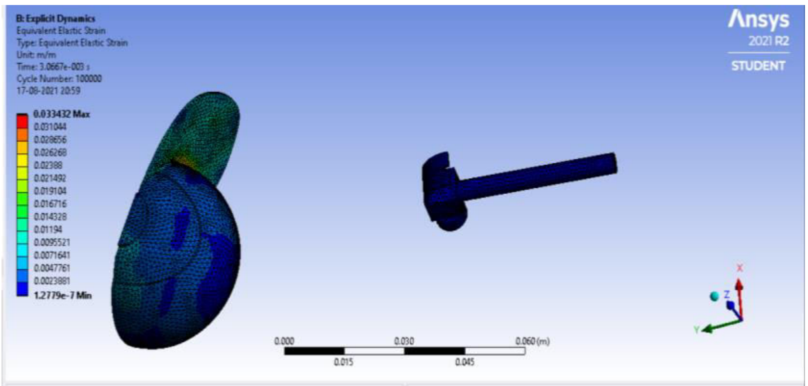
Case-1 (At F= 19.6N)



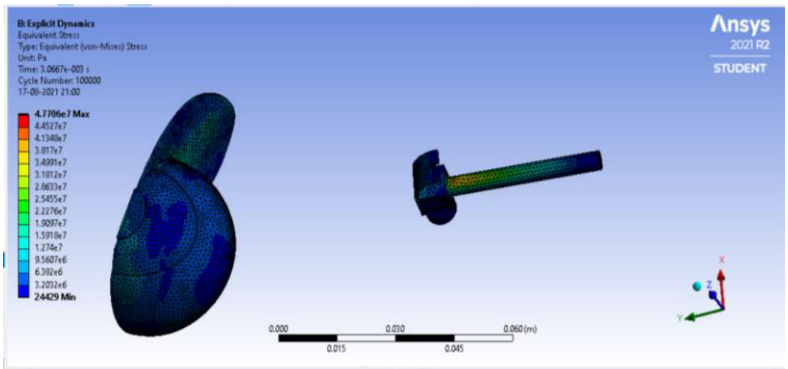
Total Deformation



Equivalent Elastic Strain



Equivalent Stress



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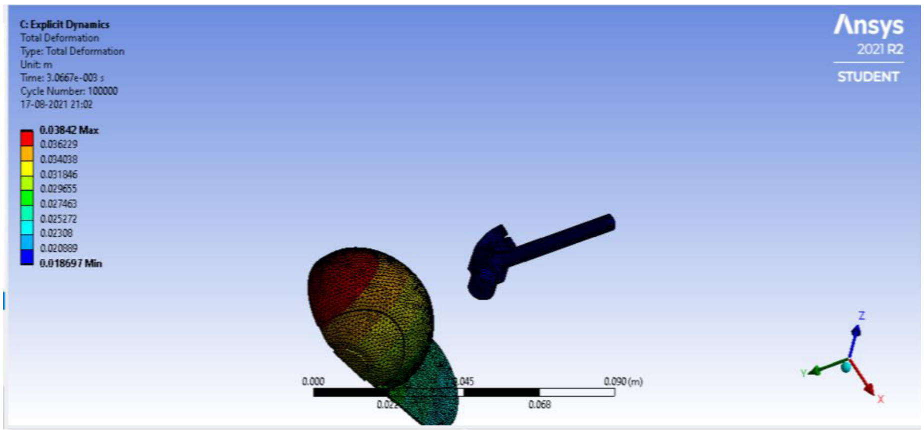
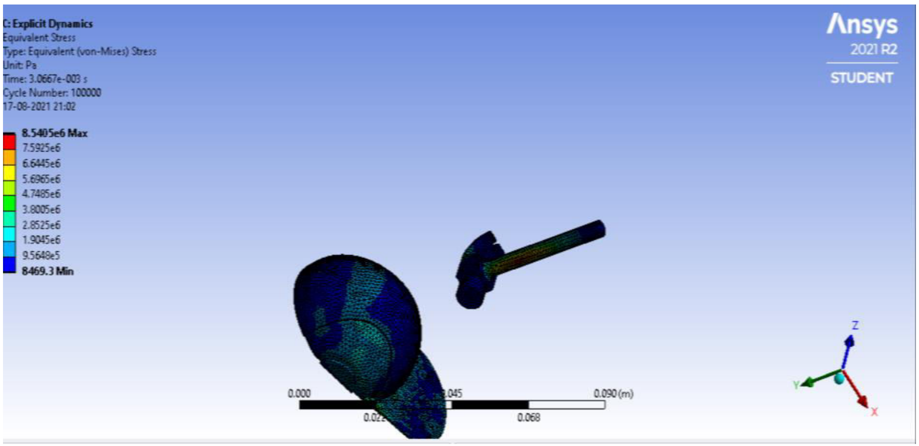
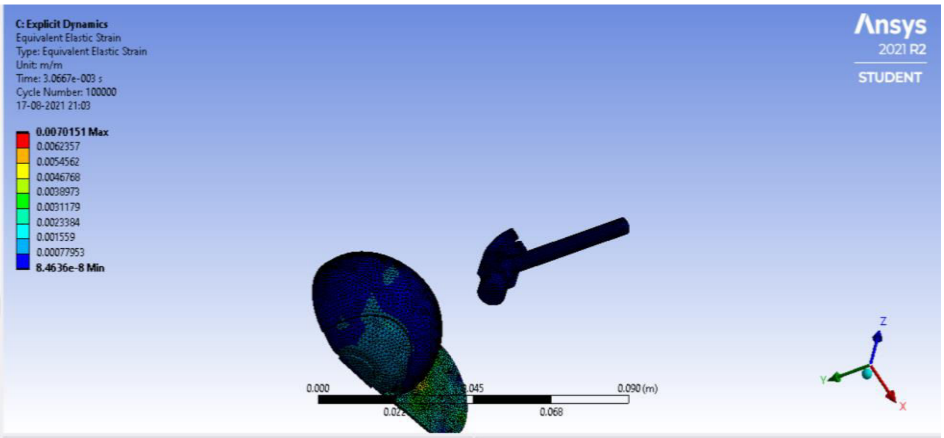
Case-2 (At F= 39.22N)
Total Deformation



Equivalent Stress



Equivalent Elastic Strain



Case-3 (At F= 58.83N)

Total Deformation

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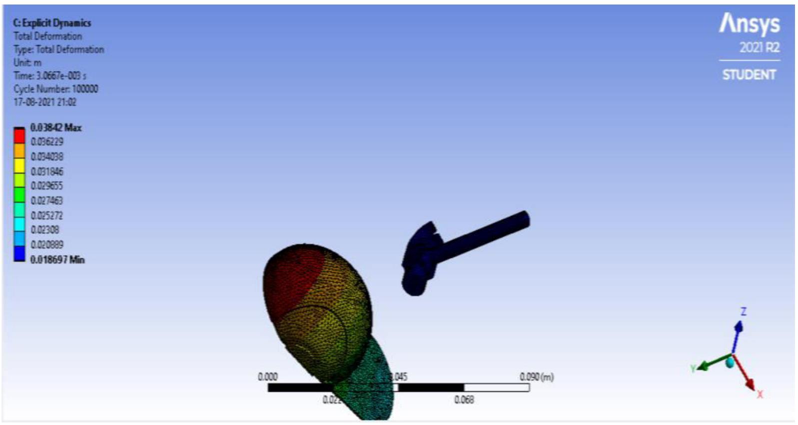
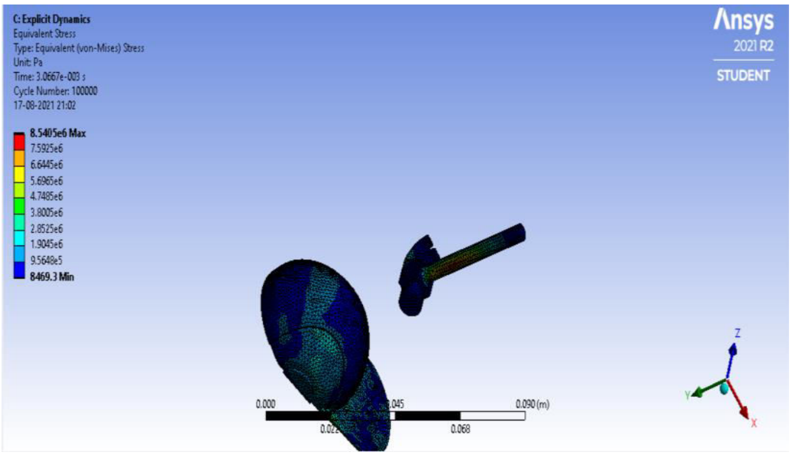
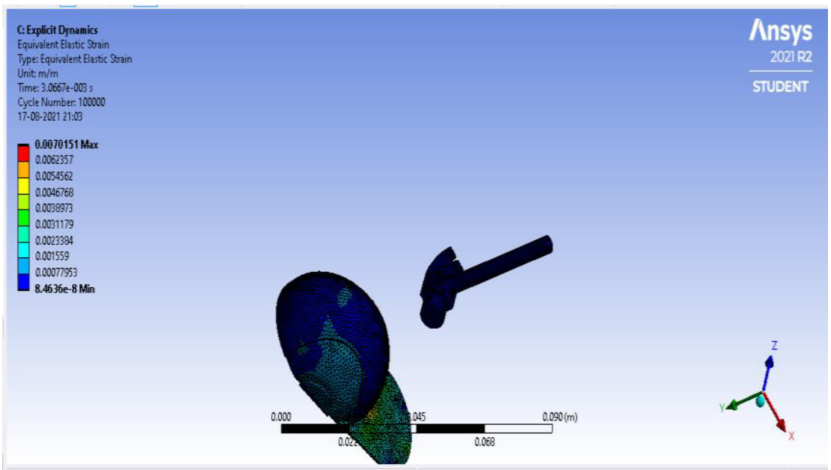


Equivalent Stress



Equivalent Elastic Strain



Case-4 (At F= 78.4N)

Total Deformation

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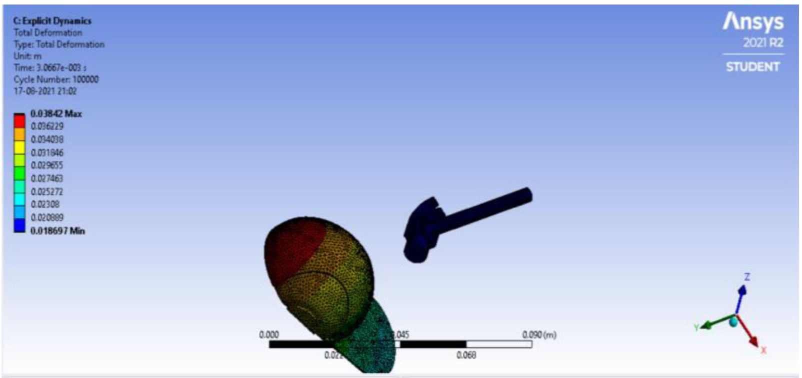
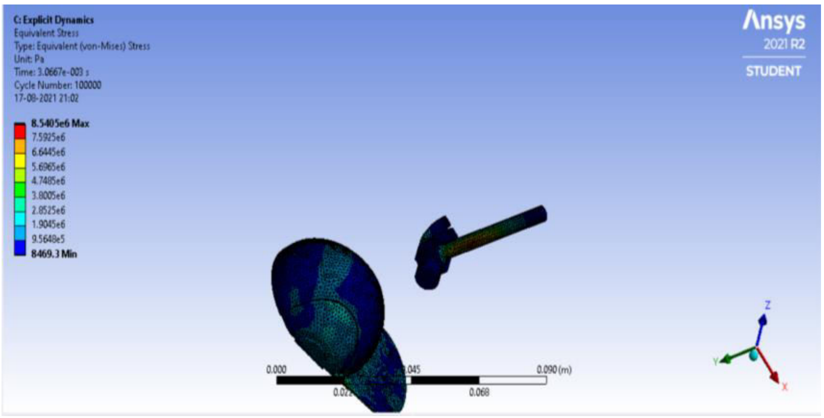


Equivalent Stress



Equivalent Elastic Strain

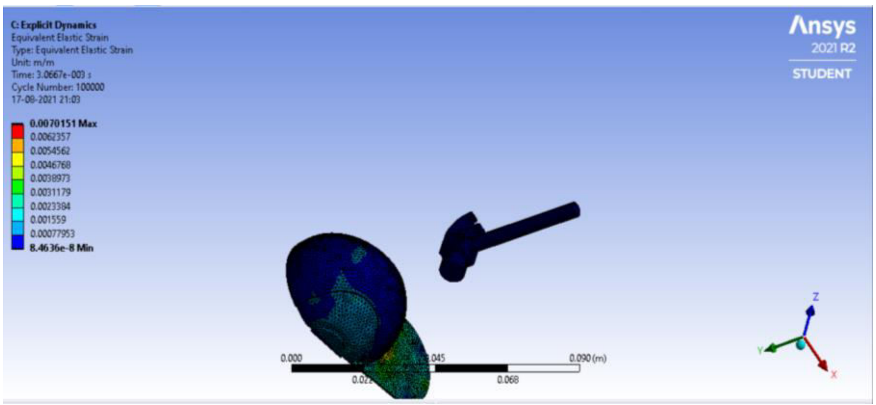


Figure 3 shows the microclimate temperature variation for different thickness. Results indicate that the temporal temperature in the space between the subject's head and the helmet increased with the microclimate thickness. It can be seen that these results are in agreement with experiment results of Egglestone et al. (Egglestone et al., 1999). It was worth mentioning that the microclimate increased with the composite helmet insulating properties

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4. CONCLUSION

This examination emphisizes the basic significance of attaching into account warm solace in cap material determination and plan issue. The primary finishes of this examination can be summed up in the accompanying focuses:

- The Jute, Bamboo, CSP and E-Glass reinforced with epoxy composite helmet has more capacity and it can resist more heat as comparted to other normal helmet.
- The industrial safety helmet has resisted more temperature and it can give more output accuracy between the helmet walls.
- Simulation results show the Jute/Bamboo fiber epoxy composite can be used to replace the existing industrial safety helmet because of its better thermal properties.

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