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# Structural Analysis of Sandwich panels Used in Aerospace Applications

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**Abstract:** Sandwich concept describes the behavior of a beam, plate, or shell which consists of three layers - two face sheets and one core. Probably the most ordinarily used sandwich conception is linear and is an extension of first order beam concept. Linear sandwich concept is of importance for the design and evaluation of sandwich panels, that are of use in building construction, vehicle building, aircraft building and refrigeration engineering. Sandwich cross sections are composite. They probably consist of a low to average stiffness core which is hooked up with two stiff exterior face-sheets. The composite has substantially larger shear stiffness to weight ratio than an identical beam made of only the core material or the face-sheet material. The composite additionally has a high tensile strength to weight ratio. Sandwich panels are usually used in aerospace purposes, similar to wing flaps, plane flooring and overhead storage bins. We construct experiment and analyze the strength and stiffness of composite sandwich panels from without problems available materials. Thus our intension is to do the evaluation on a well-designed sandwich panel arrangements used for plane Wing & fuselage structures & different safety applications via utilising ANSYS.

## I. INTRODUCTION

Composite materials are commonly utilized in at present's contemporary world. With the advent of recent substances, production procedures and new utility areas, and so on, composite materials have turn out to be one of the crucial appealing areas in engineering. As in lots of areas of engineering, commonplace applications are founded on analytical ways and with the increasing complexity of the geometries, boundary stipulations and fabric, in close to each case, the usage of analytical approaches become very tedious if not unattainable. At this point, the use of computational methods comes into picture. With the support of computational methods, particularly finite element method (FEM) for structural analyses, extremely tricky problems can be treated with fine accuracy. The disadvantage of making use of computational methods is that, with a view to get accurate outcome, an excessive amount of computational time is needed, and this raises when the concern turns into more elaborate. Additionally, FEM units require a unique study before the model is sent to the solver. In this thesis, honeycomb buildings (HC), which is a designated type of composite structure are investigated. HC structures are most often utilized in sandwich buildings. When you consider that of the net-style constitution of the HC's, the sandwich structure produced from HC's is relatively complicated from the modeling and analysis factor of view. The goal on this publish-graduate learn is to generate an orthotropic identical model that can be used as a substitute of the honeycomb constitution itself.

Consequently, a first-class reduces within the preprocessor time and computation time will also be performed. The generated equivalent model can be utilized mainly in the preliminary design stage of the design approach. Due to the fact that of the nature of the preliminary design stage, the necessities, the geometries, and the plenty of any type, alternate very almost always, which resolves the main issue to get the results for the up-to-date design. In addition to those, there are lots of special HC's with specific mobile phone sizes, wall thicknesses and fabric that may be easily observed on the market. Therefore, as a substitute of making use of a finite element model that absolutely units the small print, a similar model can be used to scale back the time spent for the evaluation of the HC structure. In the following chapters, it is going to be visible that the similar model offers macro scale results, which means that in an effort to get the outcome for the micro scale, i.e. the stresses on the mobile phone partitions and neighborhood displacements, an extra certain 3-D model must be used.

### General

An aircraft is a device that is used for, or is intended to be used for, flight in the air. Major

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categories of aircraft are airplane, rotorcraft, glider, and lighter-than-air vehicles. [Fig.1-2] Each of these may be divided further by major distinguishing features of the aircraft, such as airships and balloons. Both are lighter-than-air aircraft but have differentiating features and are operated differently. The concentration of this handbook is on the airframe of aircraft; specifically, the fuselage, booms, nacelles, cowlings, fairings, airfoil surfaces, and landing gear. Also included are the various accessories and controls that accompany these structures. Note that the rotors of a helicopter are considered part of the airframe since they are actually rotating wings. By contrast, propellers and rotating airfoils of an engine on an airplane are not considered part of the airframe.

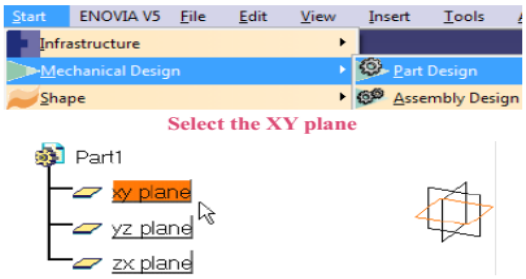

Fig.1-2. Examples of different categories of aircraft, clockwise from top left: lighter-than-air, glider, rotorcraft, and airplane.

## II. MATERIALS USED IN SANDWICH PANELS

Aluminum is the third most considerable element (after oxygen and silicon), and essentially the most abundant metal, in the Earth's crust. It makes up about 8% by using weight of the Earth's strong surface. Aluminum metallic is simply too reactive chemically to occur natively. Rather, it's observed combined in over 270 different minerals. The chief ore of aluminum is bauxite. Aluminum is great for the metal's low density and for its capability to resist corrosion because of the phenomenon of passivation. Structural accessories made out of aluminum and its alloys are valuable to the aerospace enterprise and are fundamental in other areas of transportation and structural materials. Probably the most useful compounds of aluminum, as a minimum on a weight foundation, are the oxides and sulfates. Regardless of its occurrence in the atmosphere, aluminum salts aren't recognized to be used by means of any type of existence. In maintaining with its pervasiveness, aluminum is well tolerated through crops and animals. Because of their occurrence, capabilities worthy (or in any other case) biological roles of aluminum compounds are of carrying on with curiosity.

**Step-1** :- (Starting Catia V5)

Select Start Mechanical Design Part design from the main bar




**Step: 2**(Model of upper face sheet 3D model)

Select→ sketch→Draw a rectangle with 1ft/1 inch

Exit work bench

By using pad option→extrude up to 1ft

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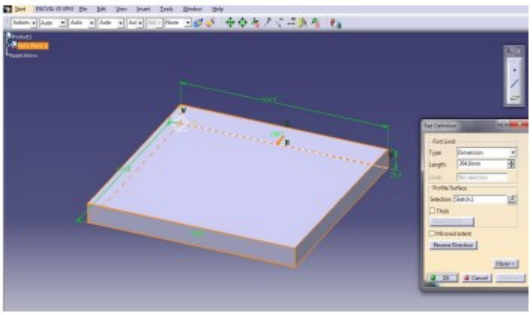

Fig.3 Model of face sheet 1(Biofoam)

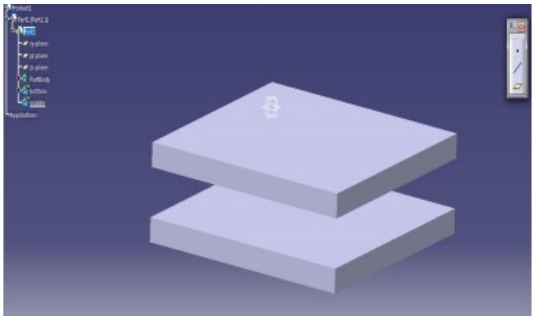

Fig.4 Model of Face sheet 2 (Biofoam)

Select→ sketch→Draw another rectangle with same dimension with 2 inches gap b/w then

Select→ rectangle→ within 2 inches thickness and extrude it up to 1ft.

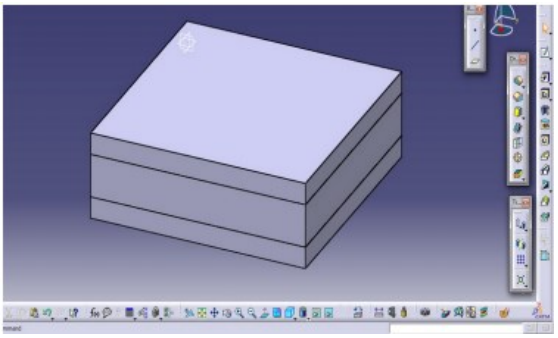

Fig.5 Model of Bio foam Core

Model of Bio foam Core Save it as IGS format & catia v.part file

## III. RESULTS AND DISCUSSION

### A. Ansys is followed up by the method called Finite Element Modeling Methods (FEM):

The finite element system (FEM) (its functional application most of the time known as finite element analysis (FEA) is a numerical procedure for finding approximate options of partial differential equations (PDE) as well as of necessary equations. The solution technique is depends on both by taking out the differential equation absolutely (consistent state issues), or rendering the PDE into an approximating process of usual differential equations, which might be then numerically integrated utilizing standard tactics such as Euler's system, Runge-Kutta, etc.

In solving partial differential equations, the principal assignment is to create an equation that approximates the equation to be studied, however is numerically stable, meaning that errors within the enter and intermediate calculations don't accumulate and purpose the ensuing output to be meaningless. There are numerous approaches of doing this, all with benefits and drawbacks. The Finite element system is a just right choice for solving partial differential equations over intricate domains (like automobiles and oil pipelines), when the domain changes (as for the duration of a solid state reaction with a relocating boundary), when the desired precision varies over the whole domain, or when the solution lacks smoothness. For instance, in a frontal crash simulation it's feasible to expand prediction accuracy in "major" areas like the entrance of the auto and diminish it in its rear (for that reason reducing cost of the simulation). One other instance could be in Numerical weather prediction, the place it's extra major to have accurate predictions over establishing particularly-nonlinear phenomena (such as tropical cyclones in the surroundings, or eddies in the ocean) instead than fairly calm areas.

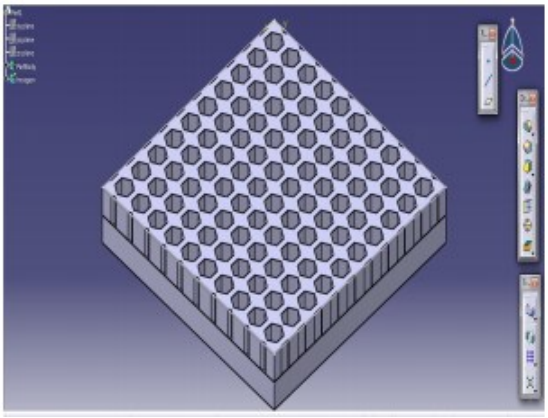

Fig.6 Model of Honey comb core

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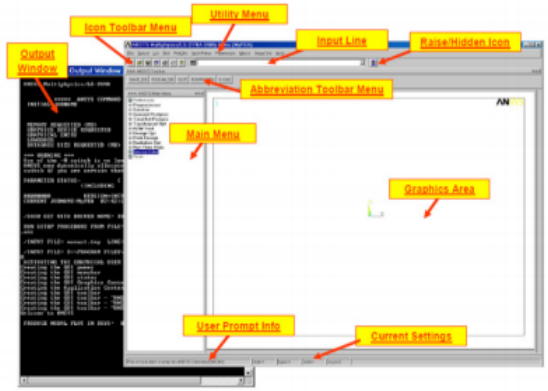


Fig.7 ANSYS window

After starting ANSYS, two windows will appear. The first is the ANSYS 8.1 Output Window

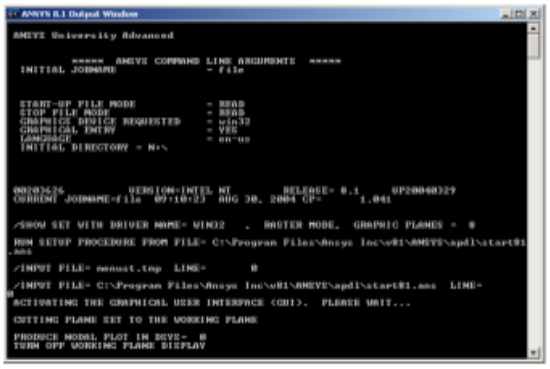

Fig.8 Output window

This window displays a listing of every command that ANSYS executes. If you encounter problems, this is a good place to look to see what ANSYS is doing or has done. This is one location where you will find all of the warnings and error messages that appear and the command that generated the warning/error. The second window is the ANSYS Research FS graphical user interface.

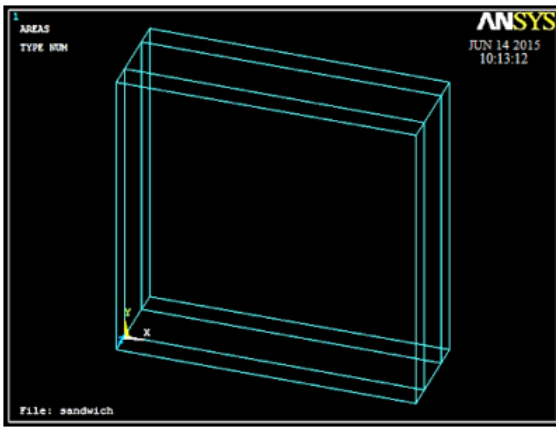


Fig.9 Catia file imported in ANSYS (Bio foam)

## V. CONCLUSION

The intention of this undertaking is to reduce the weight of a plane, so by using making use of the light weight composite materials we can cut down the burden they are nothing but Sandwich panels. Although they must be high force substances with extra stiffness. So through assuming them as a cantilever beam, via making use of hundreds on it we can get the minimum & maximum stresses performing on a sandwich panels when the loads are performing on the free finish. With the analyzed results for the given parameters Hereby we conclude that

» Honey comb constructions have so much stiffness & heavy weight.

» Whereas bio foam with same residences with gentle weight.

» so that they can justify that by utilizing bio foam we can reduce the weight of an aircraft.

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