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NUMERICAL AND ANALYTICAL INVESTIGATIONS OF CYLINDRICAL PANEL SUBJECTED TO DIFFERENT LOADS

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ABSTRACT:

The weight reduction of the cylindrical panel can have a certain role in the general weight reduction of the vehicle and is a highly desirable goal. Substituting composite structures for conventional metallic structures has many advantages because of higher specific stiffness and strength of composite materials. The materials used for these analyses are composite materials. Static & linear layer analysis to determine the deformation, stress of the cylindrical panel, modal analysis to determine the natural frequency and deformation for mode shapes. And we are using layer stacking method for 3, 5 and 7 layers for analysis of steel, E-glass polyester and glass fiber reinforced plastic material.

3D modelled by using the software CREO and analysis done in ANSYS software.

Keywords: panel and cylindrical panel,CREO,ANSYS.

1. INTRODUCTION

CYLINDRICAL PANEL

The eigenfrequencies and eigenmodes of a skinny isotropic cylindrical panel are calculated. The purpose of the analysis is to study the performance of the MITC shell elements mixed to factor mass factors (PMASS).

The panel is supported with four springs connected to the corners of the plate. Thus, the panel isn't always completely restrained and a shift of one.Zero must be applied with a view to be capable of clear up the eigenvalue problem. Curved panel model: Mesh includes 10 by 14 Q4 factors or five by means of 7 Q8/Q9 factors.

A Composite fabric (additionally called a composition fabric or shortened to composite, that's the commonplace call) is a cloth crafted from two or extra constituent substances with considerably one of a kind physical or chemical houses that, whilst mixed, produce a material with characteristics extraordinary from the person components. The man or woman components stay separate and wonderful in the completed shape. The new material can be desired for lots motives: not unusual examples encompass substances which might be stronger, lighter, or much less highly-priced whilst in comparison to standard substances. More recently, researchers have additionally all started to actively include sensing, actuation, computation and verbal exchange into composites, which might be referred to as Robotic Materials.

Typical engineered composite substances consist of:

•mortars, concrete

•Reinforced plastics, together with fiber-reinforced polymer

•Metal composites

•Ceramic composites (composite ceramic and metallic matrices) Composite substances are typically used for buildings, bridges, and structures inclusive of boat hulls, swimming pool panels, race vehicle bodies, bathe stalls, bathtubs, storage tanks, imitation granite and cultured marble sinks and countertops. The maximum advanced examples carry out mechanically on spacecraft and aircraft in worrying environments.

HISTORY

The earliest guy-made composite materials were straw and dust mixed to form bricks for building production. Ancient brick-making was documented through Egyptian tomb art work.
Wattle and daub is one of the oldest man-made composite substances, at over 6000 years antique.[2] Concrete is also a composite cloth, and is used more than any other guy-made fabric within the international. As of 2006, about 7.Five billion cubic metres of concrete are made every year—multiple cubic metre for every person on Earth.

II.LITERATURE SURVEY

Vibration Analysis of Cylindrical Sandwich Aluminum Shell with Viscoelastic Damping Treatment

This paper has implemented the constrained viscoelastic layer damping remedies to a cylindrical aluminum shell the usage of layerwise displacement theory.The transverse shear, the everyday lines, and the curved geometry are precisely taken under consideration in the gift layerwise shell version, that could depict the zig-zag in-aircraft and out-of-aircraft displacements. The damped natural frequencies, modal loss factors, and frequency response functions of cylindrical viscoelastic aluminum shells are as compared with those of the base thick aluminum panel with out a viscoelastic layer. The thickness and damping ratio of the viscoelastic damping layer, the curvature of proposed cylindrical aluminum structure, and placement of damping layer of the aluminum panel have been investigated using frequency reaction characteristic. The provided outcomes show that the sandwiched viscoelastic damping layer can efficaciously suppress vibration of cylindrical aluminum shape.

Three-Dimensional Exact Free Vibration Analysis of Spherical, Cylindrical, and Flat One-Layered Panels

The paper proposes a three-dimensional elastic analysis of the free vibration hassle of 1-layered round, cylindrical, and flat panels. The precise solution is evolved for the differential equations of equilibrium written in orthogonal curvilinear coordinates for the free vibrations of clearly supported systems.These equations consider an genuine geometry for shells with out simplifications. The important novelty is the possibility of a preferred formulation for unique geometries. The equations written in popular orthogonal curvilinear coordinates permit the analysis of spherical shell panels and that they mechanically degenerate into cylindrical shell panel, cylindrical closed shell, and plate instances. Results are proposed for isotropic and orthotropic systems. An exhaustive evaluate is given of the vibration modes for a number of thickness ratios, imposed wave numbers, geometries, embedded materials, and angles of orthotropy. These

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results can also be used as reference solutions to validate -dimensional models for plates and shells in both analytical and numerical form (e.G., closed solutions, finite detail method, differential quadrature technique, and worldwide collocation technique).

INTRODUCTION TO CAD

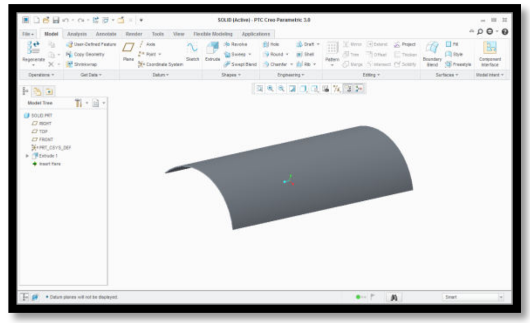
Computer-aided design (CAD) is using laptop structures (or workstations) to aid within the advent, change, analysis, or optimization of a layout. CAD software is used to increase the productiveness of the clothier, improve the great of layout, improve communications via documentation, and to create a database for production. CAD output is frequently within the form of digital documents for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used.

INTRODUCTION TO CREO

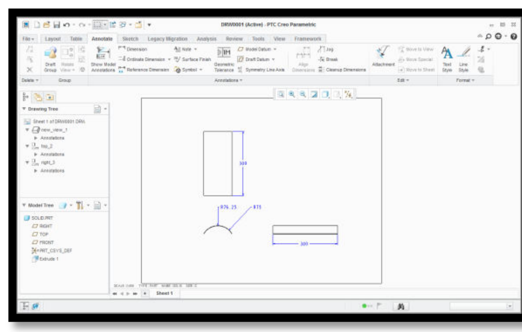
PTC CREO, formerly referred to as Pro/ENGINEER, is 3D modeling software used in mechanical engineering, design, manufacturing, and in CAD drafting carrier firms. It turned into one of the first 3-d CAD modeling programs that used a rule-primarily based parametric device. Using parameters, dimensions and functions to capture the behavior of the product, it is able to optimize the development product in addition to the design itself.

The name become changed in 2010 from Pro/ENGINEER Wildfire to CREO. It was introduced through the organisation who developed it, Parametric Technology Company (PTC), all through the release of its suite of design products that includes programs which includes assembly modeling, 2D orthographic views for technical drawing, finite detail analysis and greater.

3D MODEL



2D MODEL



INTRODUCTION TO FEA

Finite element evaluation is a technique of solving, normally approximately, certain problems in engineering and science. It is used specially for troubles for which no precise solution, expressible in a few mathematical shape, is available. As such, it is a numerical in preference to an analytical technique. Methods of this type are wanted due to the fact analytical strategies cannot cope with the real, complicated troubles which can be met with in engineering. For instance, engineering electricity of substances or the mathematical principle of elasticity may be used to calculate analytically the stresses and lines in a bent beam, but neither will be very successful in locating out what's going on in a part of a car suspension device for the duration of cornering.

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INTRODUCTION

ANSYS is wellknown-reason finite detail evaluation (FEA) software bundle. Finite Element Analysis is a numerical method of deconstructing a complicated system into very small pieces (of person-exact length) called factors. The software implements equations that govern the behaviour of these factors and solves all of them; creating a comprehensive clarification of ways the machine acts as a whole. These outcomes then can be offered in tabulated, or graphical forms. This kind of analysis is typically used for the layout and optimization of a machine some distance too complex to analyze by hand. Systems that may match into this category are too complicated due to their geometry, scale, or governing equations.

STATIC ANALYSIS

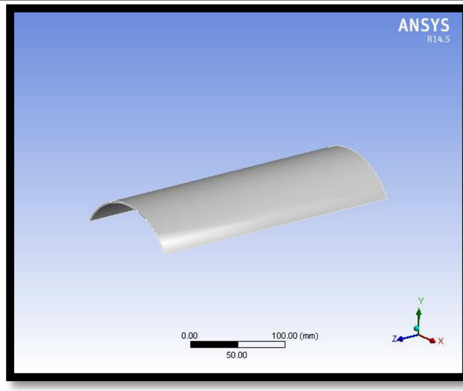
Save Creo Model as .iges format

→→Ansys → Workbench→ Select analysis system → static structural → double click

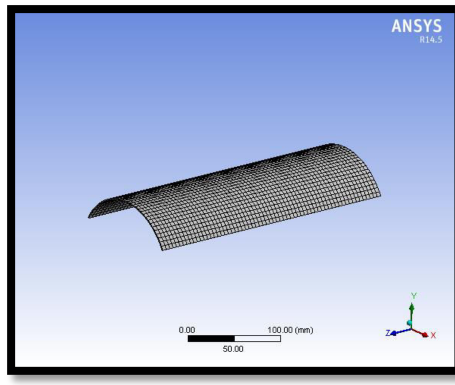
→→Select geometry → right click → import geometry → select browse →open part → ok

→→ Select mesh on work bench → right click →edit

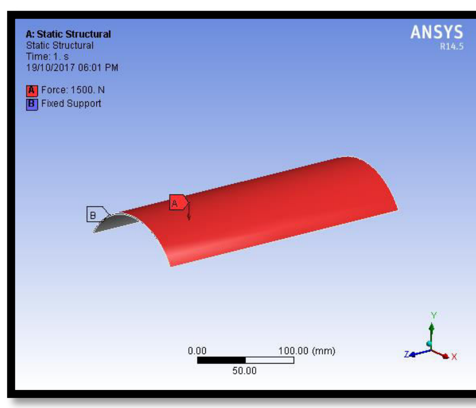
Double click on geometry → select MSBR → edit material →



Select mesh on left side part tree → right click → generate mesh →



Select static structural right click → insert → select rotational velocity and fixed support → Select displacement → select required area → click on apply → put X,Y,Z component zero →



Select force → select required area → click on apply → enter rotational velocity

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Select solution right click → solve →

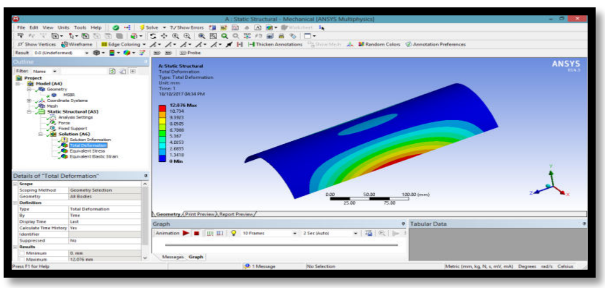
Solution right click → insert → deformation → total → Solution right click → insert → strain → equivalent (von-mises) →

Solution right click → insert → stress → equivalent (von-mises) →

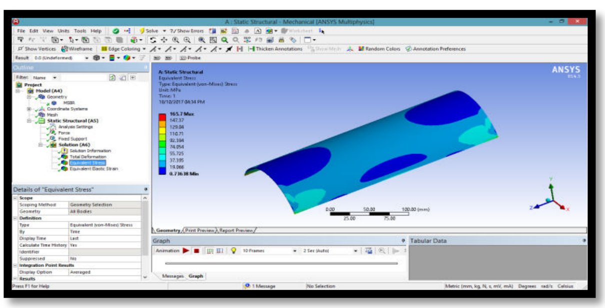
Right click on deformation → evaluate all result

MATERIAL – POLYESTER

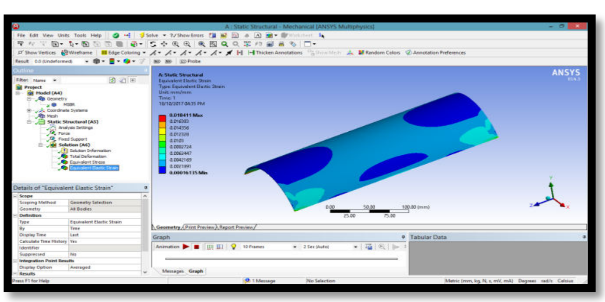
Deformation



Stress

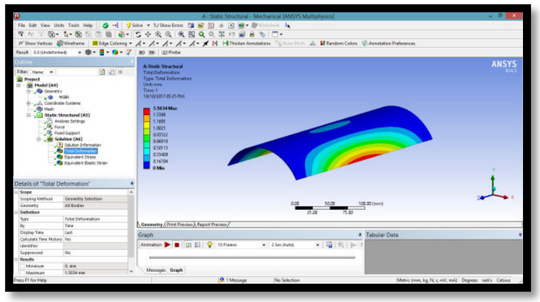


Strain

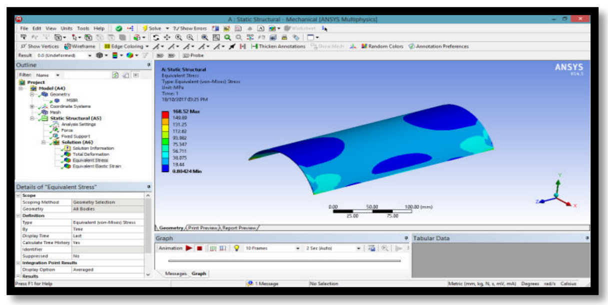


MATERIAL – E-GLASS

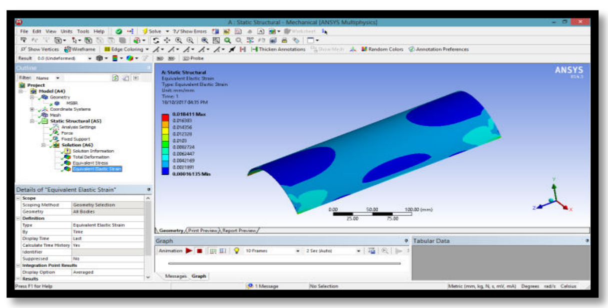
Deformation



Stress



Strain



MODAL ANALYSIS

MATERIAL – POLYESTER

MODE SHAPE 1

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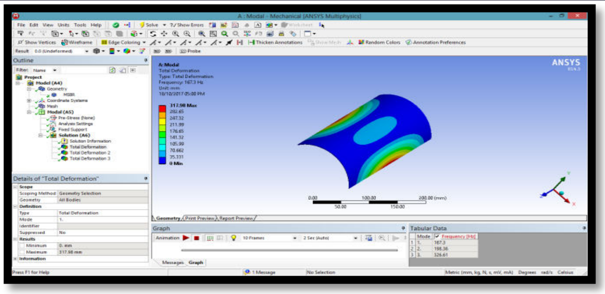
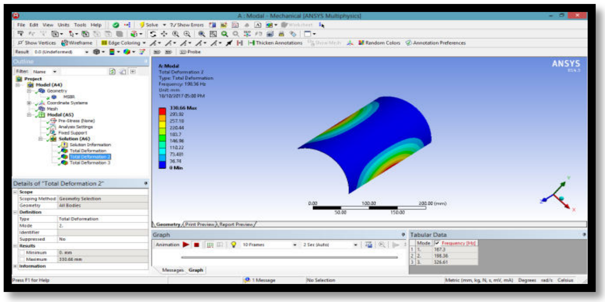
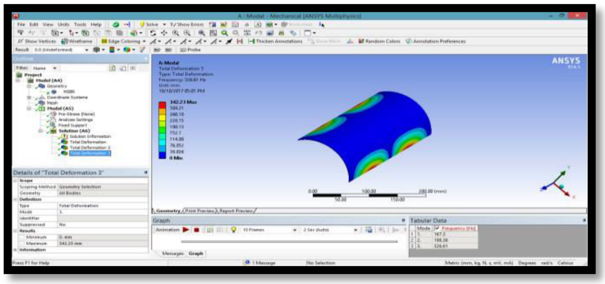


MODE SHAPE 2



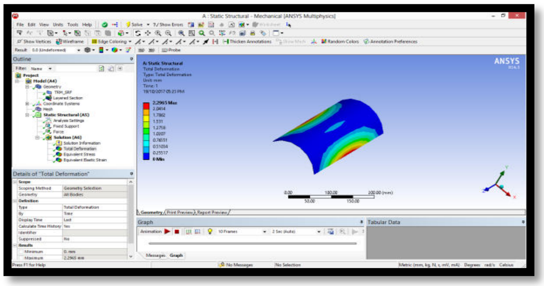
MODE SHAPE 3



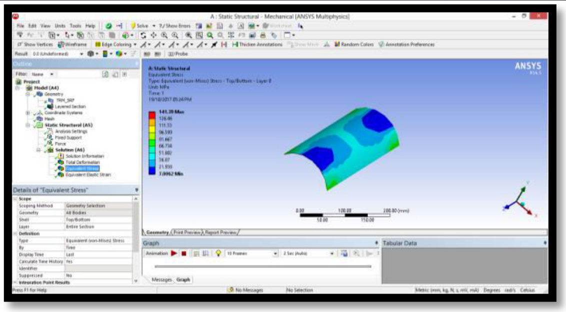
LINEAR LAYER STATIC ANALYSIS

FOR 7 LAYERS

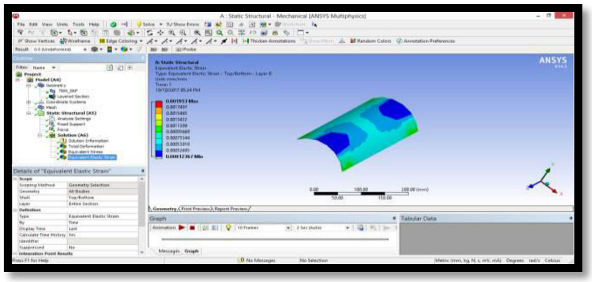
DEFORMATION



STRESS



STRAIN



RESULTS AND DISCUSSIONS

STRUCTURAL ANALYSIS

Loads (N)	Materials	Deformation(mm)	Stress (N/mm2)	strain
1500	E-glass	1.5034	168.52	0.0023277
	polyester	12.076	165.7	0.018411
	GFRP	2.1697	170.89	0.0034306
1200	E-glass	1.2027	134.82	0.0018621
	polyester	9.6606	132.56	0.014729
	GFRP	1.7358	136.71	0.0027228

MODAL ANALYSIS RESULTS TABLE

Material	Mode shapes	Deformation (mm)	Frequency (Hz)
E-glass	1	164.48	245.35
	2	171.22	290.84
	3	177.02	479.76
polyester	1	317.98	167.3
	2	330.66	198.36
	3	342.23	326.61
GFRP	1	317.68	394.49
	2	330.91	467.53
	3	341.82	772.43

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LINEAR LAYER STATIC ANALYSIS

Layer stacking	Deformation(mm)	Stress (N/mm2)	strain
3	2.362398	142.831	0.0019728
5	2.9728	166.78	0.002306
7	2.29665	141.39	0.001953

CONCLUSION

The materials used for those analyses are composite substances. Static & linear layer analysis to decide the deformation, stress of the cylindrical panel, modal analysis to decide the herbal frequency and deformation for mode shapes. And we are the use of layer stacking technique for 3, 5 and 7 layers for evaluation of metal, E-glass polyester and glass fiber strengthened plastic cloth.

By gazing the static evaluation the deformation, pressure and strain values are increases by way of growing the masses. The stress values are

much less for polyester cloth while we compare the E-Glass and glass fiber strengthened plastic fabric.

By gazing the modal analysis the deformation values are greater for polyester fabric while we evaluate the E-Glass and glass fiber bolstered plastic cloth.

Through staring at the linear layer analysis the strain values are less for 7 layers.

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