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Finite Element Study of Behavior of Sandwich Beam Under Static And Dynamic Conditions

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Abstract- Sandwich Beams are broadly utilized in the development of aviation, common, marine, car and other elite structures because of their high explicit firmness and quality, phenomenal weariness opposition, long toughness and numerous other better properties thought about than the regular metallic materials.

Sandwich shafts are composite frameworks having high solidness to-weight and Strength-to-weight proportions and are utilized as light weight burden bearing parts. The utilization of flimsy, solid skin sheets clung to thicker, lightweight center materials has enabled industry to construct solid, firm, light, and strong structures. Because of the utilization of viscoelastic polymer constituents, sandwich shafts can show time-subordinate conduct. This investigation looks at the conduct of sandwich bars driven by the viscoelastic elastic center. Limited component (FE) strategy is utilized to break down the general transient reactions, symphonious reactions and the static reactions of the sandwich frameworks subject to a gathered point load at the mid range of the pillar.

In this examination the skin, i.e; the top and base layers are comprised of mellow steel while the center is comprised of elastic. The pressure, strain, and twisting fields are broke down. The center thickness is differed keeping the skin thickness consistent and the conduct of the sandwich bar is considered under static and dynamic conditions.

In this proposition static and dynamic investigation of sandwich shafts with various center thickness under essentially bolstered condition is considered. Parametric investigations demonstrate that the variety of center thickness significantly affects the common frequencies and mode shapes and greatest redirections.

Keywords- Sandwich beam, viscoelastic, deformation fields, harmonic and the static responses

I. Introduction

A sandwich organized composite is an exceptional class of composite materials that is manufactured by appending two flimsy yet hardened skins to a light weight however thick center. The center material is typically low quality material, however its higher thickness furnished the sandwich composite with high twisting firmness with by and large low thickness. Open and closes cell organized froths like polyvinylchloride, polyurethane, polyethylene or polystyrene froths, and honeycombs are usually utilized center materials.

Sandwich pillars are composite frameworks having low weight and high quality and firmness attributes. Normal sandwich bars comprise of two meager skin layers isolated by a thick inward center. The utilization of slender, solid skin sheets clung to thicker, lightweight center materials has enabled industry to construct solid, firm, light, and strong structures. At the point when the skins and center are consolidated, they work as a solitary auxiliary segment containing every one of the upsides of every part. Sandwich shafts have high solidness to-weight and solidarity to-weight proportions and are utilized as light weight burden bearing segments. Elastic and compressive burdens are chiefly conveyed by the skins, while transverse shear stresses are transcendently experienced by the center. Regularly, materials, for example, steel and aluminum sheets are utilized for the skins. The fundamental capacity of the center is to expand the flexural unbending nature of the sandwich bar, limiting transverse twisting. Honeycombs, froths, and folded centers made of polymers or metals are regularly utilized.

Sandwich structures can be broadly utilized in sandwich boards; these sorts of boards can be in various kinds, for example, FRP sandwich board, aluminum composite board and so forth. FRP polyester fortified composite honeycomb board (sandwich board) is made of polyester strengthened plastic, multi-pivotal high-quality glass fiber and PP honeycomb board in exceptional antiskid track example form through the procedure of steady temperature vacuum adsorption and agglutination and cementing.

Because of the utilization of polymer constituents, sandwich bars can show time subordinate conduct. Visco versatility is the investigation of time-subordinate materials demonstrating a consolidated flexible strong and thick liquid conduct when exposed to outside mechanical loadings. The reaction of viscoelastic materials is resolved not just by the present condition of the heap, yet additionally by the historical backdrop of the stacking.

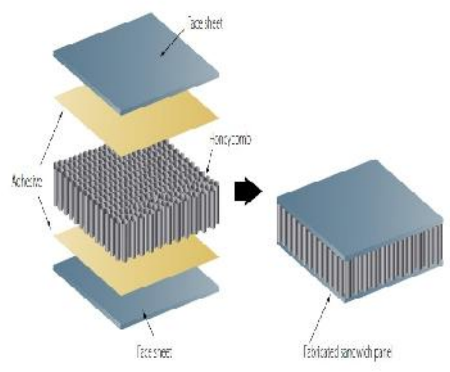

Fig-1 Sandwich Structure

II. Modelling of Sandwich beam

A sandwich beam whose core thickness is varied is modeled using ANSYS. The specifications of the beam are as follows:

DIMENSIONS OF THE BEAM

a=0.02m…… thickness of the skin
w=0.2m…….width of the beam
P=5000N…… load acting on the beam
l=1m………...length of the beam
Dimension of core varies.

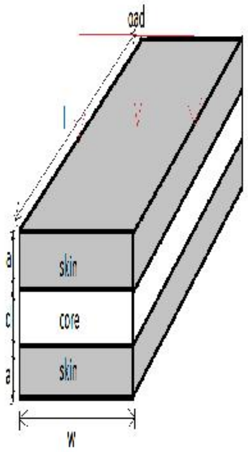

Fig-1.1 Dimensions of Beam

Table-1: Variation of core thickness

Condition	**Thickness(m)**
1	0.01
2	0.015
3	0.02
4	0.025
5	0.03

Table -2 MATERIAL PROPERTIES

PARAMETER	SKIN	CORE
Material	Mild Steel	Rubber
Young's Modulus	210GPa	0.2GPa
Poisson's Ratio	0.303	0.48
Density	8050 kg/m^3	1100 kg/m^3

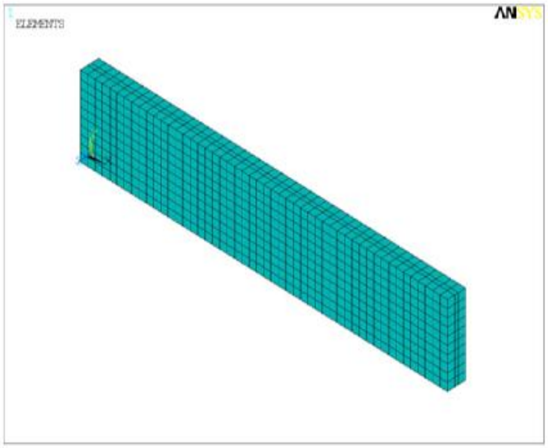

Fig-2 Modelled Beam

III.Static Analysis

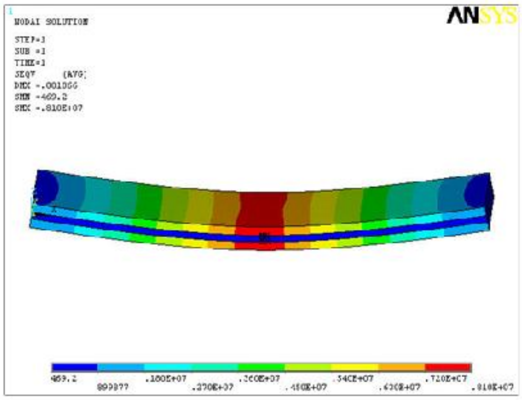

Fig-3 Von Misses Stress for 0.01m thick

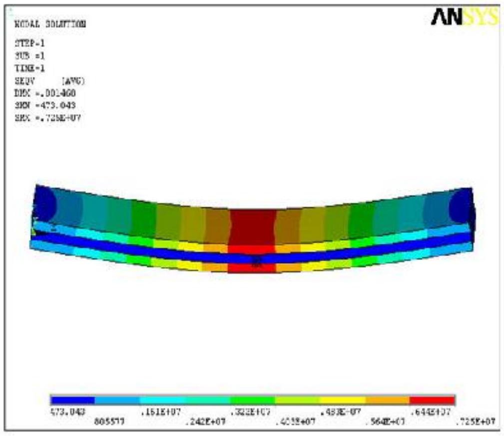

Fig-4 Von Misses Stress for 0.015m thick

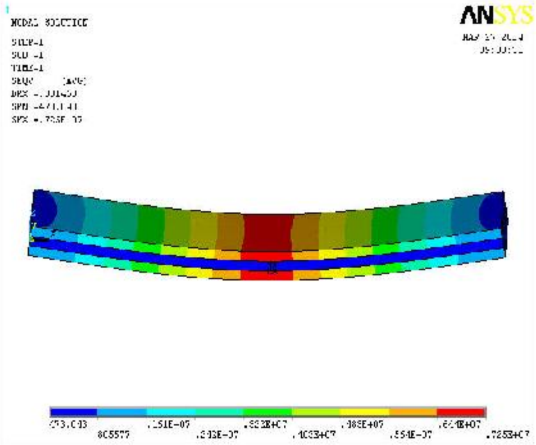

Fig-5 Von Misses Stress for 0.02 m thick

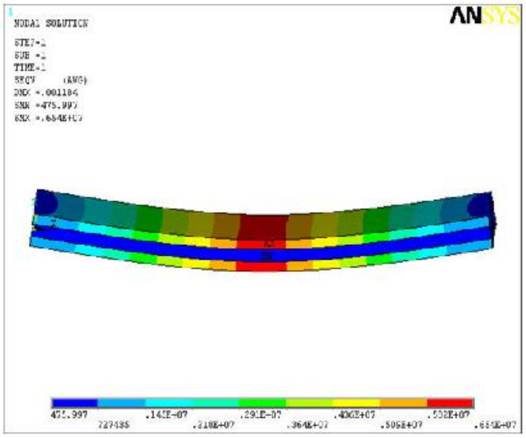

Fig-6 Von Misses Stress for 0.025 m thick

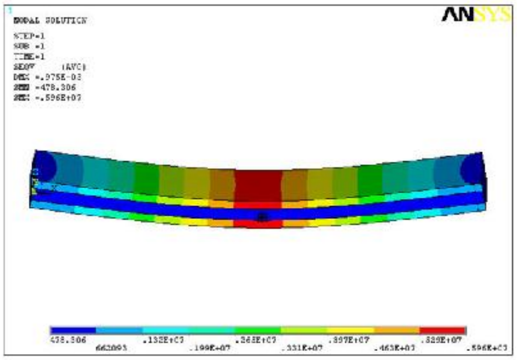

Fig-7 Von Misses Stress for 0.03 m thick

Variation of Deflection and stress with thickness

Thickness (m)	Deformation	Stress(Pa)
0.01	0.0024	0.912e7
0.015	0.00186	0.810e7
0.02	0.00146	0.725e7
0.025	0.00118	0.654e7
0.03	0.00097	0.596e7

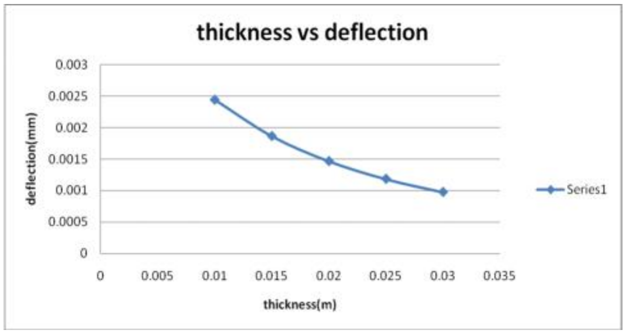

Fig-8: graph between deflection and core thickness

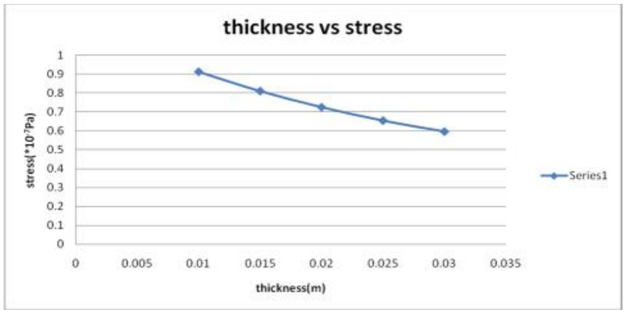

Fig-9 Graph between Vonmisses stress and Core Thickness

From this we can note that the deflection is decreasing with that of the core thickness. It is the same as in case of the stress also. This decrease will continue in the same fashion as the skin thickness is constant. When the value of the skin changes then an optimum value could be found out.

IV Modal Analysis

Six Mode shapes are considered and modal analysis is done for every thickness value.The following are the mode shapes for the thickness value of 0.02m

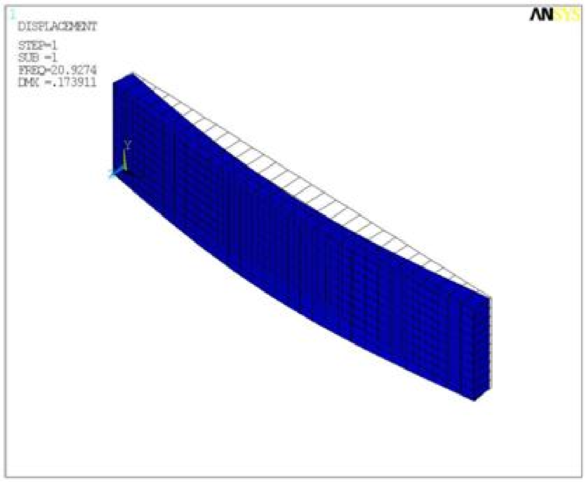

Fig-10: First Mode Shape

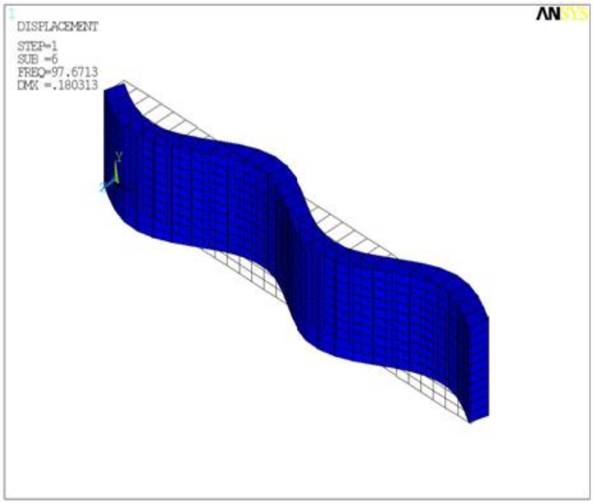

Fig-11: Fifth Mode Shape

Modal Frequencies

Mode shape	0.01m	0.015m	0.02m	0.025m	0.03m
1	39.987	45.41	50.88	56.54	61.429
2	158.54	179.35	199.8	219.76	239.15
3	240.85	262.75	260.6	258.62	256.62
4	264.98	267.70	292.96	316.54	338.42
5	351.21	394.96	437.12	477.38	515.58
6	494.89	548.86	598.90	594.21	589.62

V Harmonic Analysis

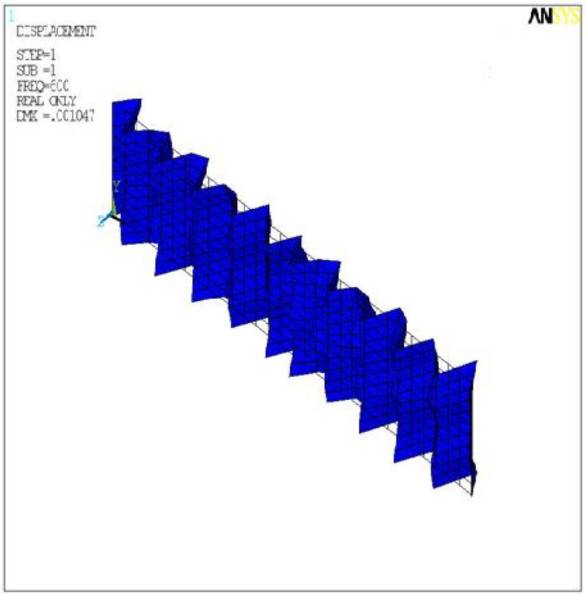

Fig-12 First mode frequency for beam with core thickness 0.01m

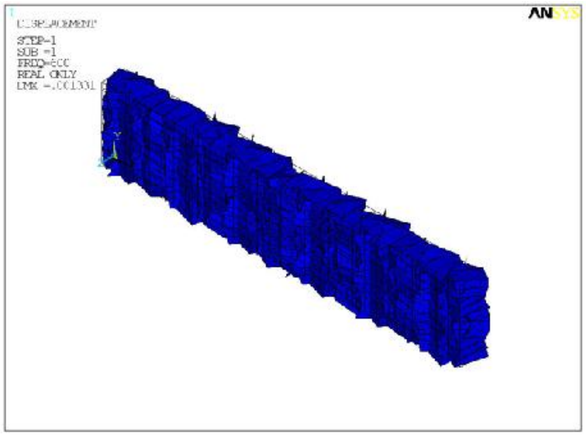

Fig-13 first mode frequency for beam with core thickness 0.025m

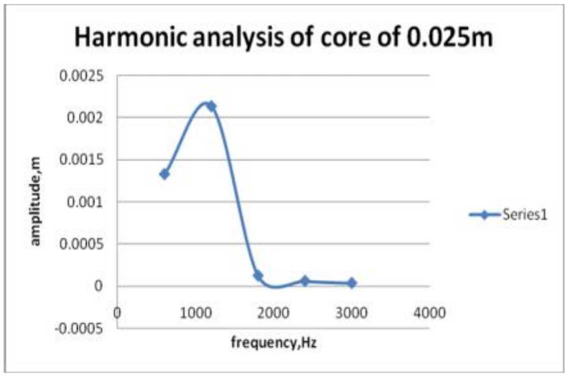

Fig-14 graph for harmonic analysis for core thickness 0.025m

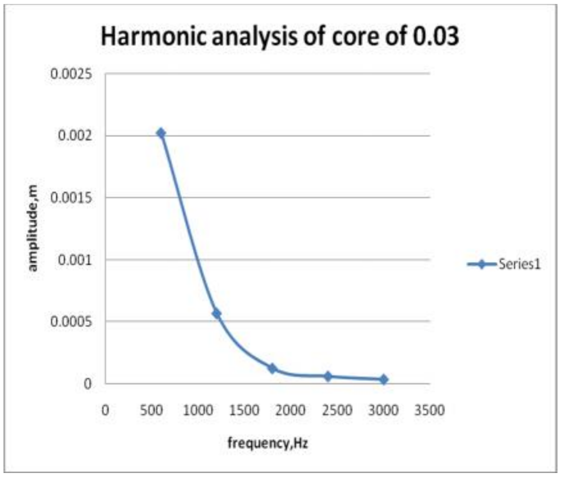

Fig-15 graph for harmonic analysis for core thickness 0.03m

The harmonic analysis is done for all the thickness values and the graphs have been plotted. It is found that the amplitude of the beam increases up to a certain frequency value and then decreases gradually. Hence we can calculate an optimal value where the amplitude may not reach very high and also the fundamental frequency could be found out**.**

VII CONCLUSIONS AND FUTURE SCOPE

Conclusions

The accompanying ends are drawn from the present work:

Analysed the sandwich shaft and watched different parameters for fluctuating thickness.

It is seen from the outcomes that the crucial recurrence increments as the center thickness expands which suggests that the regular recurrence likewise increments as the center thickness increments.

By this examination we can decide the recurrence at which vibrations are most extreme and abstain from working the framework at that recurrence and work it at different frequencies.

Future Scope

Examination can be done on various materials with various stacking groupings and limit conditions and fluctuating center and skin thickness. Further examination should be possible for forecast of delamination stress. The skin thickness can likewise be shifted alongside that of the center thickness and relations could be discovered.

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