Analysis of Composite Cantilever Beam Using Computer Application

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ABSTRACT

Components of composite materials have been used extensively for many years as composite products do far better than formercomparable homogenous isentropic products. Innovative composite/compound materials like delicate reinforced compounds are used extensively in the aviation industry. The combined benefits of composite materialslike special strength, strong strength to stiffness &weight, the ability to counter rust, and a lower thermal expansion make this a final choice in aircraft and other applications. The planner's freedom to choose between different basic constituents for Co-ordinated products will effective enough to achieve features to make a specific application / devices appealing to them. In this work our key focus has been on working out the pressure and reducing the visual pressure that can be used in a wide range of industry activities. For this comparative version of AS4 3501-6 Graphite-Epoxy is selected for this task. The research are done in this paper will allow us to demonstrate the strength of the beam as a result of Transverse load. Herein the stress and the deflection are calculated by a micro-editorial device developed in a MATLAB and results are validated with Finite Element Analysis software.

Keywords: Cantilever Beam, composite, isotropic materials, stress, deflection, stiffness, MATLAB, FEA

INTRODUCTION

Designing of composite products for mechanical equipment makes use of a fully-service process in which the designer has to inspect or draw on specific objectives such as strength, compensation, weight, wear, rust, etc. which are hanged. Toencounter the necessities. The industry has a urgently required for thread-reinforced composites due to their particularly high / strength comparison / specifically for applications where weight reduction is essential. By using composite products in practice, pressure on structures can be greatly reduced[1]–[3]. It is also possible to further reduce the weight by making the maximum material system itself such as fiber training, stacking sequence, ply thickness, and so on. Because many researchers are trying to make the best use of modules either by reducing the laminate thickness, thus reducing pressure/weight, or by increasing the laminate strength of a laminate thickness[4][5].

The structural elements with one side can bigger than the other dimensions as a rod, bar, column, or base. This would depend on the precisesituations. A structural member is particularly involved in the curling. The terms of a rod (or bar) and column for those members conflict most with an axis and an axis, respectively[6][7].

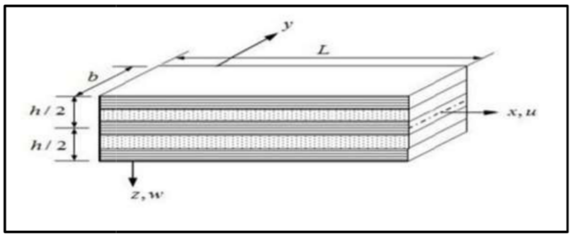

Figure 1. Composite Beam Laminates

Different research personalities has done various work in the composite materials and many advance materials are coming in market. Mr. NITIN JAHURI, Mr. HARISHCHANDRA THAKUR, Mr. RAGHAVENDRA MISHRA[8] presented paper on Stress analysis in FRP composites. In this they describes that as deformation is reduced in composite/compound laminates, on the other hands quantity of layers essentially be raised, which results in increase of von-misses stress.

RESULT AND DISCUSSION

A composite analytical solver is developed in excel sheet for the analysis of the stress and deflection of a /compound composite beam, which is developed in an Excel sheet and values are calculated are matched with FEM analysis.

After calculating in the MATLAB the results tabulated are as follows illustrated in *Figure 2*.

Properties	Analytical Excel sheet	Matlab value	FEM Value	% Error
Deflection (mm)	1.859	1.823	1.77	4.78
Stress (MPa)	1780.56	1760.1	1731	2.75

Figure 2. Results

These systematic outcomes by Excel sheet which is authenticated by Autodesk Helius Composite Software. This software is mostly employed for an analysis of Composite structure. The stress & strains at top & bottom surface of each ply are calculated The Analytical results for stress and strains at ply level are as below as *Figure 3* and *Figure 4*.

Ply No	Position	ε_1	ε_2	γ_{12}
1	Bottom	-0.27897	0.029240	0.08390
1	Top	-0.20923	0.021930	0.06293
2	Bottom	0.02193	-0.20922	-0.06293
2	Top	0.01462	-0.13948	-0.04195
3	Bottom	-0.04146	-0.08341	0.15410
3	Top	-0.02073	-0.04170	0.07705
4	Bottom	-0.04171	-0.02072	-0.07705
4	Top	4.12E-18	1.90E-18	1.4E-17
5	Bottom	4.12E-18	1.90E-18	1.4E-17
5	Top	0.041705	0.020727	0.07705
6	Bottom	0.020728	0.041705	-0.07705
6	Top	0.041456	0.083410	-0.15410
7	Bottom	-0.01462	0.139486	0.041954
7	Top	-0.02193	0.209229	0.062931
8	Bottom	0.209229	-0.02193	-0.06293
8	Top	0.278973	-0.02924	-0.08390

Figure 3. Ply level Strain values in MPa (Analytical)

Ply No	Position	σ_1	σ_2	τ_{12}
1	Bottom	-38232.9	-402.341	429.237
1	Top	-28674.7	-301.756	321.928
2	Bottom	2500.183	-1942.38	-321.924
2	Top	1666.789	-1294.92	-214.618
3	Bottom	-5895.79	-896.928	788.334
3	Top	-2947.89	-448.464	394.167
4	Bottom	-5776.95	-299.581	-394.167
4	Top	5.69E-13	2.82E-14	7.21E-14
5	Bottom	5.69E-13	2.82E-14	7.21E-14
5	Top	5776.953	299.581	394.167
6	Bottom	2947.897	448.464	-394.167
6	Top	5895.795	896.928	-788.334
7	Bottom	-1666.78	1294.925	214.618
7	Top	-2500.18	1942.380	321.928
8	Bottom	28674.73	301.756	-321.928
8	Top	38232.98	402.3419	-429.237

Figure 4. Ply Level Stress values in MPa (Analytical)

COCLUSION

From this study, the researcher's analysis of Excel and MATLAB results in almost all the same results, which may be used for further work, when values obtained from Analytical & Experimental examination,system monitors the identical pattern. +ve &-ve values are for compressive and tensile values respectively. The most significant strain occurs at ply 4 top and ply 5 bottom. The strain increases from ply 1 to ply 4 and then reducing from ply 5 to ply 8.

For some degree of analysis, the values followsimilar pattern as a strain. The minimum stress at level 4 and 5, and stress rises from ply 4 to 1 and ply 5 to 8. The maximum/peak stress is at ply number 8 and 1 but ply 1 is in compression and ply 8 is in tensile. As everyone knows that composites are better in compression and are not tension. Thus, in analyzing failure criteria when maximum stress failure criteria is applied to the composite/compound beam, it fails at ply 8 fails as a consequence of a transverse tension pressure (p). This shows that the results found and are authenticating to each other. This study may be extended to include the optimization of a Comparison structure such as Plate, Beam, and Shell etc. All the equipment that are developed can be used for that survey and can be useful for Optimization.

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