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Static structural analysis of simply supported beam with distributed load

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ABSTRACT

This paper studies the maximum & minimum deformation and stress analysis of a Simply Supported Beam with evenly distributed load which comes under Static Structure analysis. The theoretical calculations are done by using the general formulae's .The computative analysis is done on ANSYS 2021 R1 (Student Version) software. On comparing the theoretical results with analytical results to those obtained from the software are approximately same.

Keywords: *Computative Analysis; Deformation; Simply Supported Beam.*

1. INTRODUCTION

In this paper Simply Supported Beam has been analyzed using Ansys Workbench where Static Structural conditions has been applied to beam.

What is Simply Supported Beam?

It is one of the most **simple** structures. It features only two **supports**, one at each end. One is a pinned **support** and the other is a roller **support**. With this configuration, the **beam** is inhibited from any vertical movement at both ends whereas it is allowed to rotate freely.

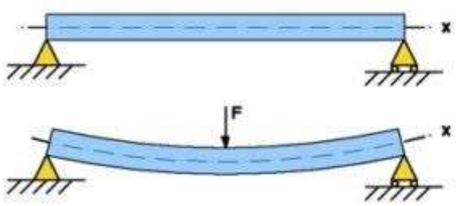


Fig. 1: Schematic Diagram of Simply Supported Beam

This paper was recommended for publication in revised form by Associate Editor 000 000-please leave blank. Removing any of the supports inserting an internal hinge, would render the simply supported beam to a mechanism, that is body the moves without restriction in one or more directions. Obviously this is unwanted for a load carrying structure. Therefore, the simply supported beam offers no redundancy in terms of supports, and if a local failure occurs the whole structure would collapse.

2. PROBLEM STATEMENT

For analysis, first, Simply Supported Beam is taken. The component below is made in Catia . One end of component is fixed and force F=5000N is evenly applied on beam, whose cross-section length is taken as 40mm*40mm and longitudinal length is taken to be 1000mm .

3. STATIC STRUCTURAL ANALYSIS

The static structural analysis of beam is performed in Ansys workbench. Where 5000N force is applied on beam evenly. Mesh size is taken as 20mm & beam is considered to be made of Structural Steel.

Table 1: Material Properties

Youngs Modulus, E :	210000 N/mm^2
Distance from neutral axis to extreme fiber, c:	20mm
Moment of inertia, I:	213333mm^4
Section Modulus, Z:	10667mm^3

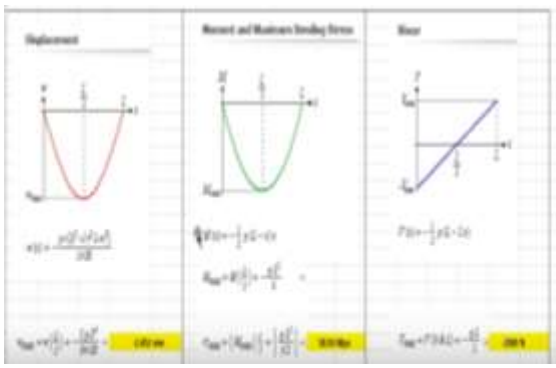


Fig. 2: Theoretical values of Beam.

3.1 Analysis of beam

Clarity of all figures is extremely important.

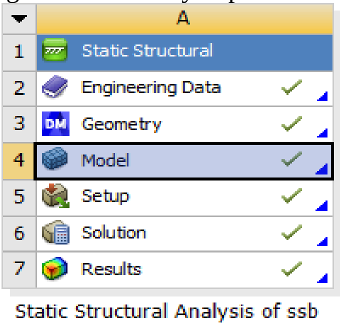


Fig. 3: Fig show the analysis has successfully worked

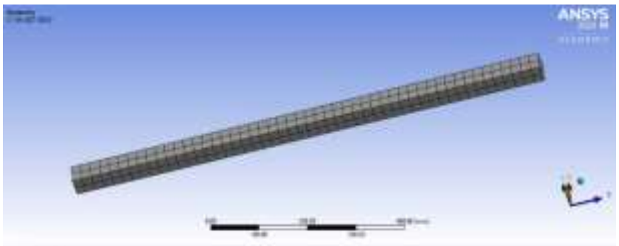


Fig. 4: Actual beam before analysis

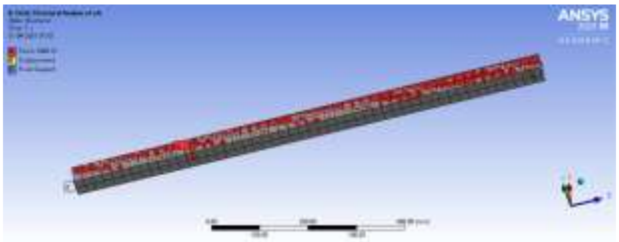


Fig. 5: Static Structure (After applying all the constraints)

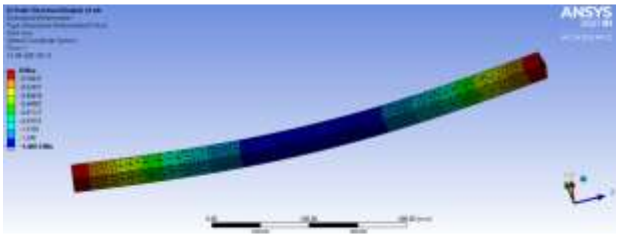


Fig. 6: Directional Deformation

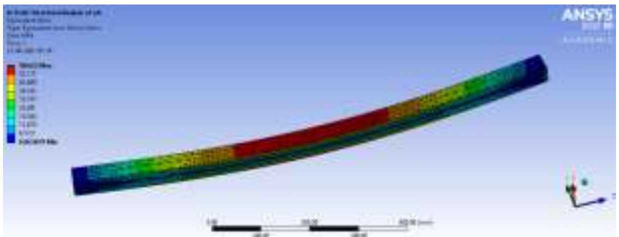
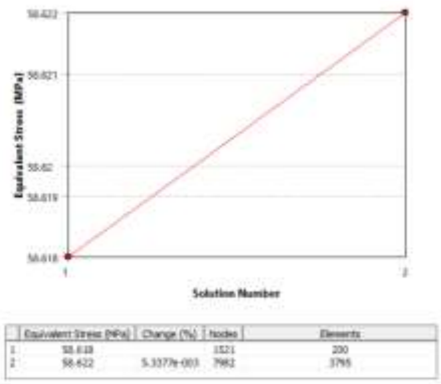


Fig. 7: Equivalent Stress



Graph 1: Convergence History

3.2.1 Analysis of beam done by path 1

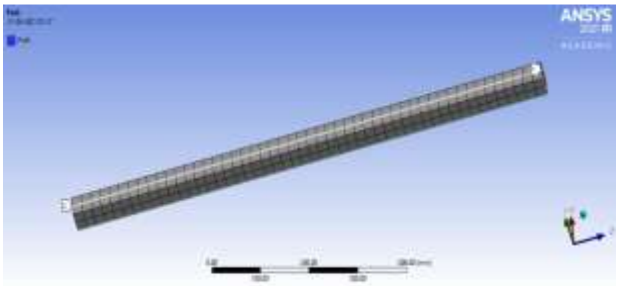


Fig. 8: Path 1(On the face of top layer)

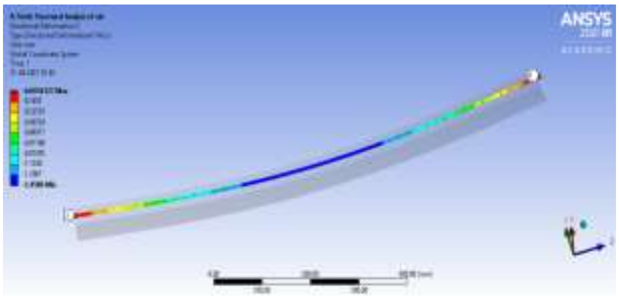
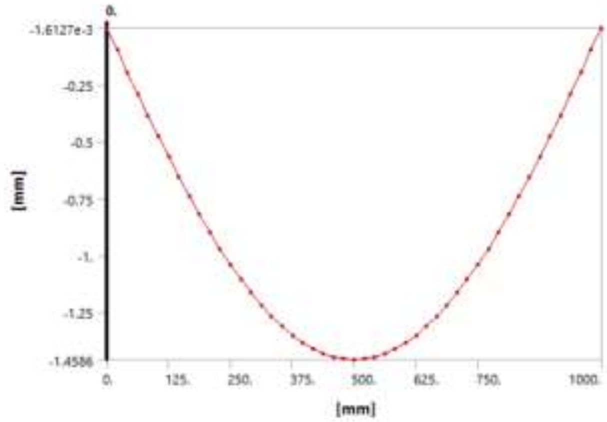


Fig. 9: Directional Deformation of path



Graph 2: Directional Deformation of path

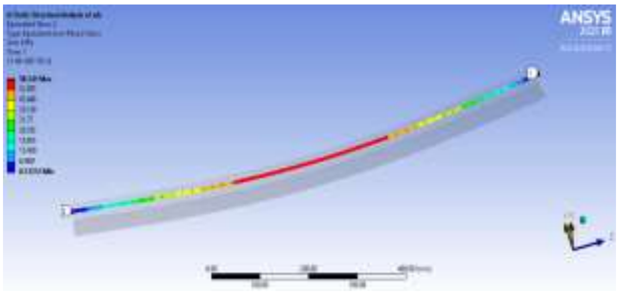
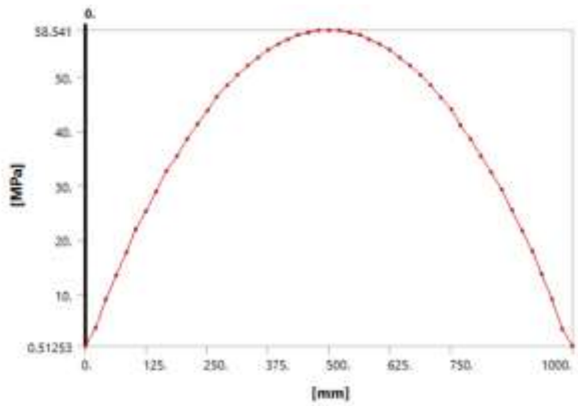


Fig. 10: Equivalent Stress of path



Graph 3: Equivalent Stress of path

3.2.2 Analysis of beam done by path 2

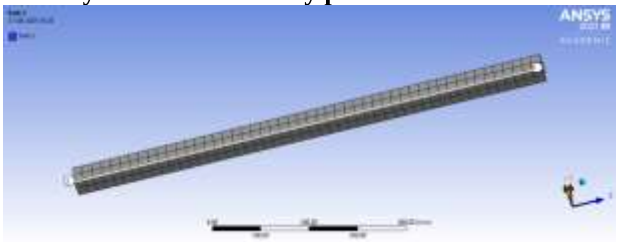


Fig. 11: Path 2(middle point i.e. from origin)

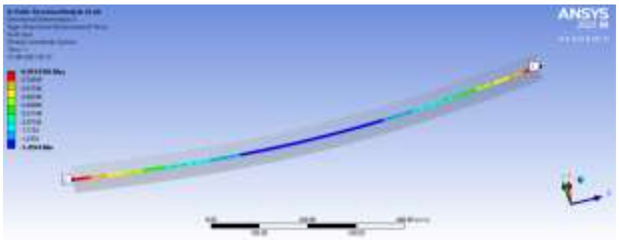
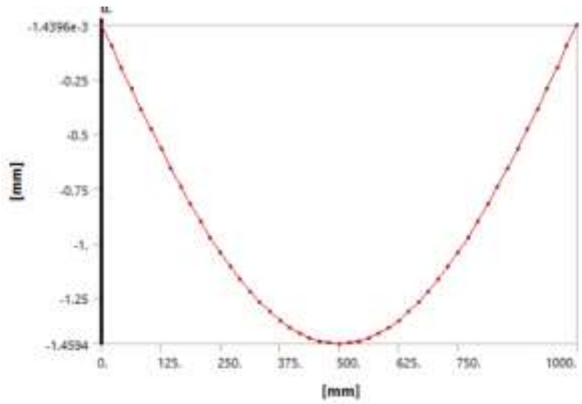


Fig. 12: Directional Deformation of path



Graph 4: Directional Deformation of path

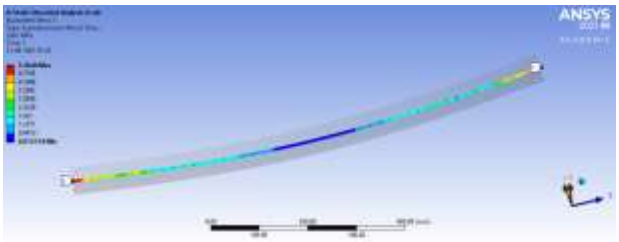
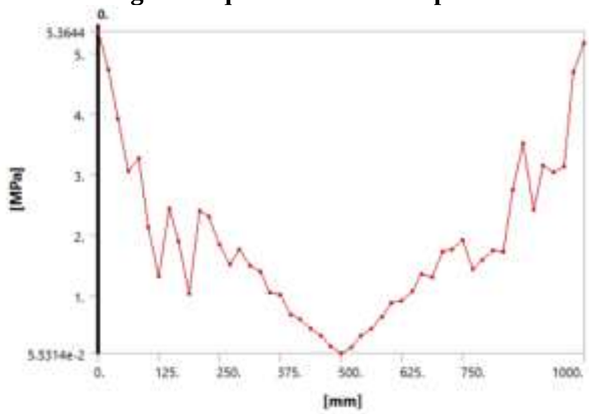


Fig. 13: Equivalent Stress of path



Graph 5: Equivalent Stress of path

4. RESULT AND DISCUSSION

- After analyzing the beam the theoretical value and Computative value came approximately same for complete beam .
- While doing path analyses the graph directional deformation for both paths were same with different values.
- Whereas the values for the Equivalent stress of path were different and the graph were varying based on the path selected.

5. CONCLUSION

When complete path was considered there were no effect on graph whereas when we selected various paths we came to know that stresses varies with path whereas deformation remains same .

6. REFERENCES

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