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STUDY OF BEHAVIOUR OF TENSILE FABRIC STRUCTURES AND ITS DESIGN

Injeti Tharun Teja

P.G. Student, Structural Engineering, SRM University,

Kattankulathur, Chennai, Tamil Nadu, India

D. Arul Prakash

Assistant professor, Department of Civil Engineering, SRM University,

Kattankulathur, Chennai, India

ABSTRACT

In this the study of the Tensile Fabric Structures (TFS) is explained briefly with regarding to its shapes and the fibre made use off. The fibres are mentioned with their properties. The analysis of tensile fabric structure is done for its deformations and stresses developed making use of ANSYS software. The design concepts of the tensile fabric structures has been mentioned.

Keywords:TFS, deformation, stresses, meshing, form-finding

OBJECTIVES

The main objective of this work is to study the forces on the tensile fabric structures, it's modelling, analysis by using Ansys software and the design concepts of the tensile fabric structures.

INTRODUCTION

A structure where the exterior shell is a fabric material spread over a framework. The fabric is maintained in tension in all directions to provide stability. A tensile structure is a construction of elements carrying only tension and no compression or bending. The term tensile should not be confused with tensegrity, which is a structural form with both tension and compression elements. Tensile structures are the most common type of thin shell structures.20

Most tensile structures are supported by some form of compression or bending elements, such as masts (as in formerly the Millennium Dome), compression rings or beams. This is most often used as a roof, as they can economically and attractively span large

distances. The design process is made more complex by the fact that the shape of tensioned cable net and membrane structures cannot be described by simple mathematical methods. They have to be found through a form-finding process either using physical or computer models. In this paper the chosen TFS is of 3.5m of its height and a span of 5m and of semi-circular canopy.

ANALYSIS

As mentioned the analysis is carried out Ansys software by the help of cata software for the purpose of modelling. The chosen model resembles us the umbrella structure in its appearance. Ansys s/w is based on finite element method and the tool MESH is incorporated for the division of elements in the structure. The analysis is done by accounting the load of fibre (PVC) on the structure and the live loads; self-weight of the structure, snow load inclusive of the wind load, considered on basis of IS: 875:1987(part IV). The loads of tension from the cables. The total structure is of mild steel and erected condition on earth.

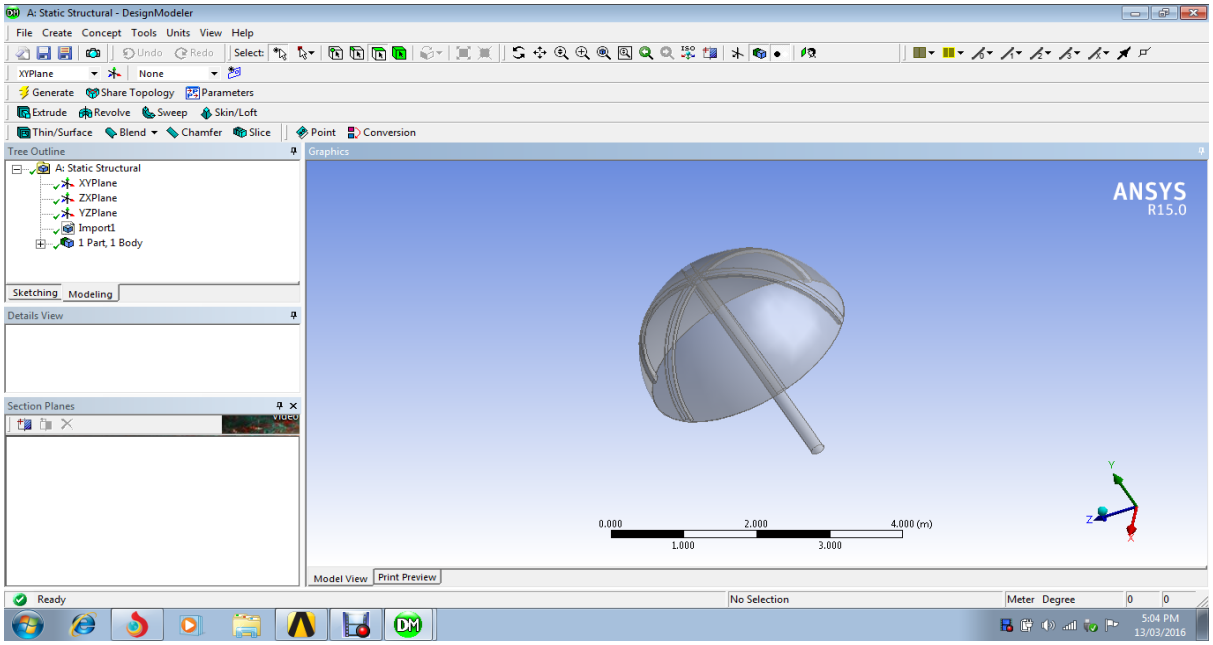

Figure 1: Modelling of Tensile Fabric Structure

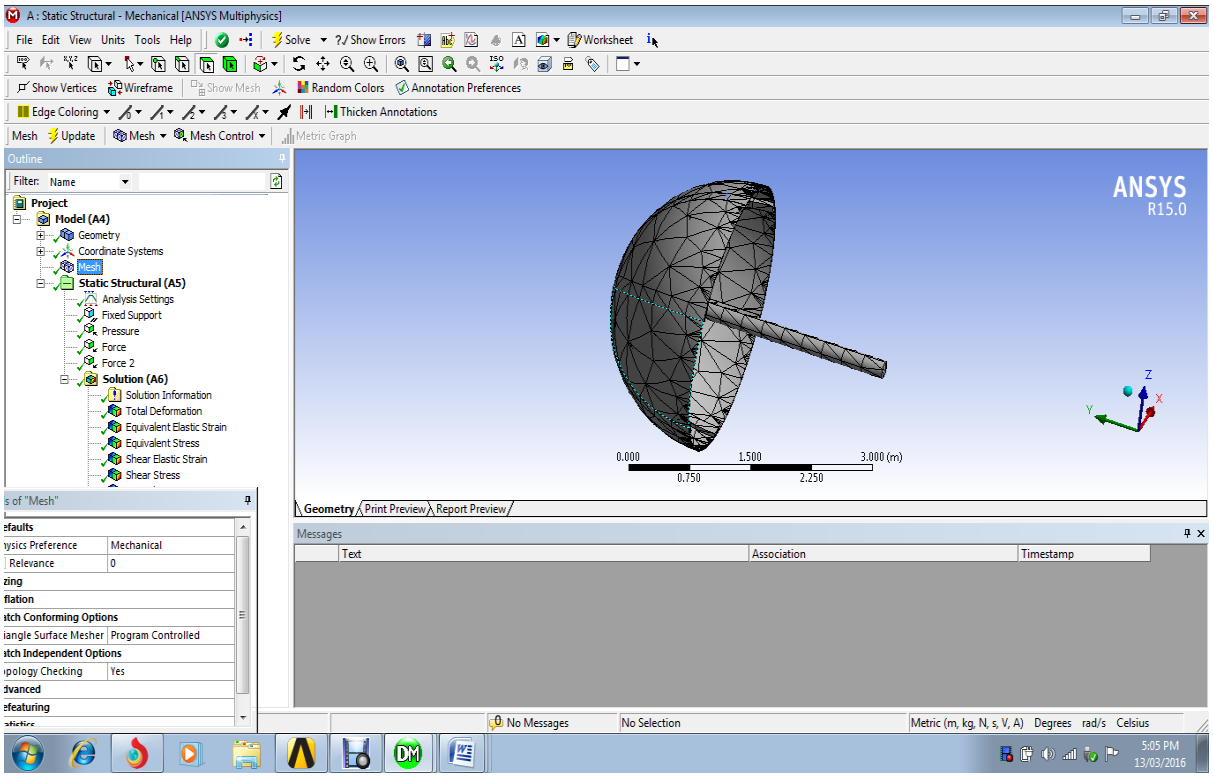

Figure 2: Meshing

RESULTS:

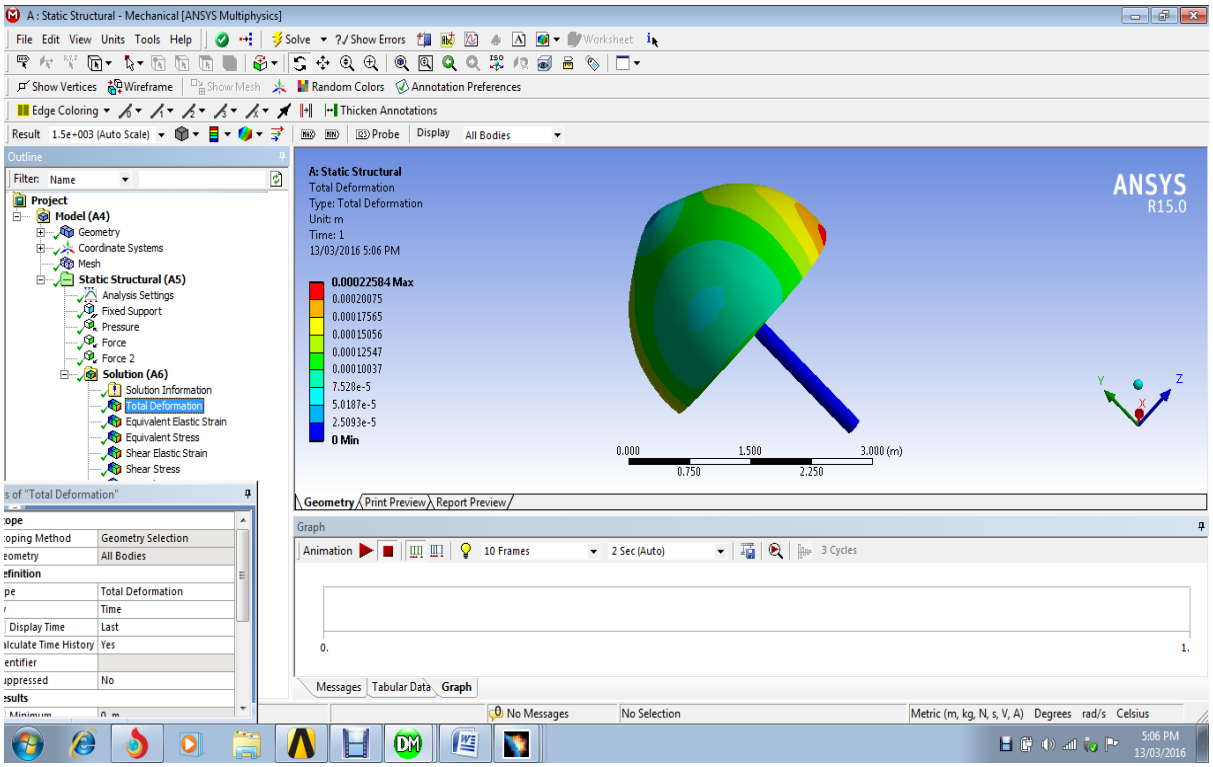

Figure 3: Total Deformation o the structure

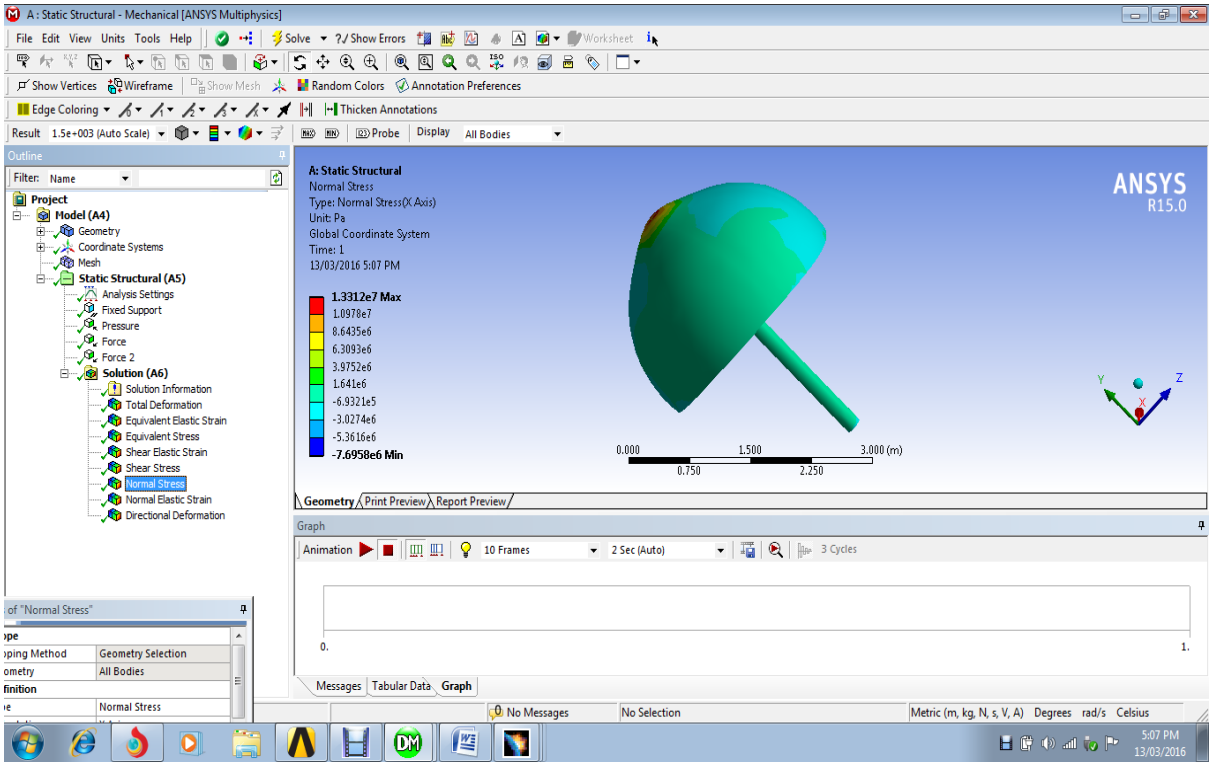

Figure 4: Normal stress

DESIGN CONCEPTS OF TFS

The design process is mainly of two steps one is of the form finding and the other is the analysis of the tensile fabric structure.

Form Finding:

The form finding is that the deciding factor of the shape of the tensile fabric structure. It depends on the stresses and the forces on the structure. The three dimensions has to be considered and the combination of different basic shapes may also be taken, such as cones, ridge and valley, barrel vaults and hypars. In our point the structure demands the canopy as the shape of the semi-circle and hence the simple shape has been considered.

Analysis:

The analysis in our current case has been done by the usage of Ansys software. The finite element method based software. This is made to make the analysis simpler and the shapes of the structure will be easily made as elements and can be analysed easily and within no time. Actually the analysis is done for static and the dynamic considerations. Thereby the obtained

results are required deformation of the structure and the stresses on the structure based on the loads acting on to the structure.

CONCLUSION

The tensile fabric structures can also be analysed by making use of softwares. Ansys made this easier because of its development as if we can incorporate the material details of the material we make use off. The deformations and the stress has been shown by this analysis. The maximum deformation for the min pressure and forces on the structure is 0.00022584m. The maximum stress for the considered forces on the structure is 1.3312e7pa. The different results can be extracted from the tools as shear stress, von-mises stress, shear elastic strain etc.

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