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Application of ANAYS Software in Analysis of Solar Panel Supporting Structure

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Abstract -*The use of renewable resources is increasing rapidly. Following this trend, the implementation of large-area solar arrays is considered to be essential. Sun is said to be the main and naturally renewable resource that helps in the production of electricity using Solar panels. In the solar farming installation, supporting structure places an important role in selecting the correct material for installation is very advantageous and important. In this paper, we are considering two materials that are steel and aluminum as a supporting structure for a single solar panel. Modeling this panel supporting structure in ANAYS software, from which stress values are obtained. Comparing the stress values for both the steel and Aluminium from which better material can be chosen.*

***Key Words*: Steel material, Aluminium material, Modelling, ANAYS Software, Supporting structure.**

1.INTRODUCTION

Sun is said to great natural resource, to use this renewable resource solar panels can be used. Supporting structure plays a vital role in the installation according to the requirement. Here in this paper, we are considering steel and Aluminium materials.

Steel is one of the most commonly used materials for construction purposes. In the manufacturing of steel, Iron is the most used raw material and in less percentages carbon, limestone, phosphorus, silicon dioxide are used. Advantages of this steel material are having high structural strength, High ductility, Easy transportation of material, good scrap valve, Easy fabrication, erection, and replacement will be more. Disadvantages of this material are it has less corrosion resistance, high weight, and high maintenance. Steel material can be available in different shapes and sizes according to the requirement, Figure 1.1 shows the different available shapes.

Figure 1.1: Different shapes of steel material

Aluminum is also one of the most used materials. Alumina and bauxite are the two Materials required for manufacturing Aluminium. The benefits of this material are good work-ability, good electrical conductivity, less weight, protection from corrosion however the material is ductile, and also the bending of this material to derive various profile configurations is difficult and ends up in the high cost. Figure 1.2 shows the different available shapes of Aluminum.

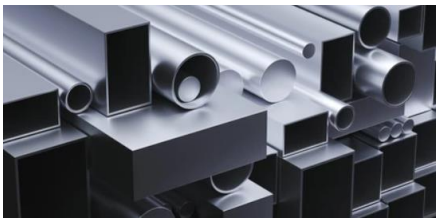

Figure 1.2: different shapes of Aluminium material

2. Literature review

A. Mihailidis, K. Panagiotidis, K. Agouridas et al [1] created the model for solar panel supporting structure with its fixed and adjustable supporting structure. For the CFD model, ANSA as pre-processor and EUROCODE are used for the load calculations, wind load was been calculated by this and for the FE model, can't be applied directly. **Georgeta Vasies et al [2]** for the analysis of the wind action on solar panels located on flat roofs with and without parapets. These simulations was been done in the ANSYS CFX software, with an angle of 45°, by it is observed that uplift forces in the corner areas of the roof on which forces bring an additional load on the supporting system.**Vijay B. Sarode et al [3]** presented the model that was done with the steel structure. And the latest FEA to work on this sector for the optimization of the design. They modeled in PRO-E software. By these, they got the best structural and optimized structural model. **G.Gadhavai Akash and Dipesh D Kundaliya et al [4] created** a model in the software by using different software for the pressure distribution by considering the environmental conditions like structure load and height of the structure. by these will be finding the critical points in the supporting structure with the use of the software. From the studied literature reviews, it can be concluded that the FEA model has to be done in desired software by providing conditions to obtain the required results. In this paper, we are creating the FEA model ANAYS software and obtaining the stress parameter as output.**Jinxin can et al [5]** discuss finding module force at a different location on the roof the member was modeled on

flat roofs using them in two different cases they are single array and multi-array. They found mean and peak module force coefficients on design parameters of tilt angle, the height of the solar panel. They conclude module force coefficient for single array cases is larger than multi-array cases.

3. Structure modeling:

Here creates the single panel model with 1000 mm X 2000mm with an angle of 450 from the horizontal support. Figure 3.1 shows the FEA model that has been created in the ANAYS software.

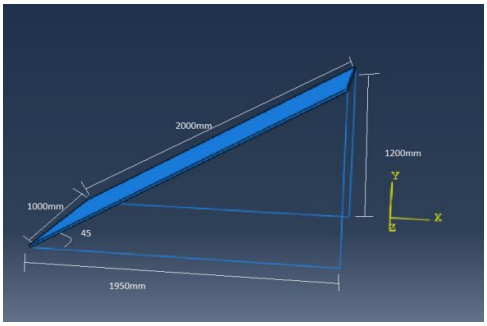

Figure 3.1: FEA model

Two models have to be created in ANAYS software with steel and Aluminium as supporting material with the dimensions as specified in the above Figure 3.1.

The material properties that have to be adopted for ANAYS software for steel material with a density of 1934 MPa, Young's modulus of 19.3 GPa, Poisson's ratio of 0.21-0.23, and yield strength of 402.58 MPa. For Aluminium, materials are a density of 7850 MPa, young's modulus of 21.5 GPa, Poisson's ratio of 0.3, and yield strength of 280 MPa. Grades that are considered for steel and aluminum are SS400 and 6063-T6.

In addition to the material properties dead load and live load of the material has to be applied for the model and also support conditions has to be applied for the model for the horizontal and the panel pinned support is provided and for the vertical support and horizontal support fixed support has to be provided.

This is the data that has been provided for the modeling of the solar panel supporting structure in ANAYS software from which obtaining stresses as an output.

Discussion of Results:

After the completion of the modeling run the model in the software from which can get the desired output of stress, strain, forces. Here we are considering stress values. This process has to be carried for both the steel and Aluminium material and obtain the results.

The maximum stress valve for the steel material is 51.58 MPa obtained from ANAYS software.

The maximum stress valve for the Aluminium material is 23.25 MPa obtained from ANAYS software

5. Conclusion:

From the obtained results it is observed that when we compare steel and Aluminium materials for the solar panel supporting structure the stress valve of the steel is more when compared to Aluminium material. So it can be stated that steel is a better material for solar panel supporting structure from the above results.

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