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Comparative Analysis of Transmission Tower

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Abstract: ***The electrical transmission line towers carry heavy electrical transmission conductors at a sufficient and safe height from ground. In addition to their self-weight they have to withstand all forces of nature like strong wind, earthquake and snow load. Therefore transmission line towers should be designed considering both structural and electrical requirements for a safe and economical design. Modeling of transmission tower by using finite element method. the horizontal displacement (X-direction) is found to be maximum for the model-10 as compared to the other models. As the height goes on increasing the displacement found to be increasing. Also as the wind speed is increasing the displacement is also found to be increasing.***
Keywords: Transmission Line Tower, Geometry of Tower, Bracing System, Dynamic Analysis

I. INTRODUCTION

India has a huge population living all over the country and the electricity supply need of this population generates requirement of a large transmission and distribution system. Also, the disposition of the primary assets for electrical power generation viz., coal, hydro potential is quite jagged, thus again adding to the transmission requirements. Transmission line is an unified system encompassing of conductor subsystem, ground wire subsystem and one subsystem for each kind of support structure.

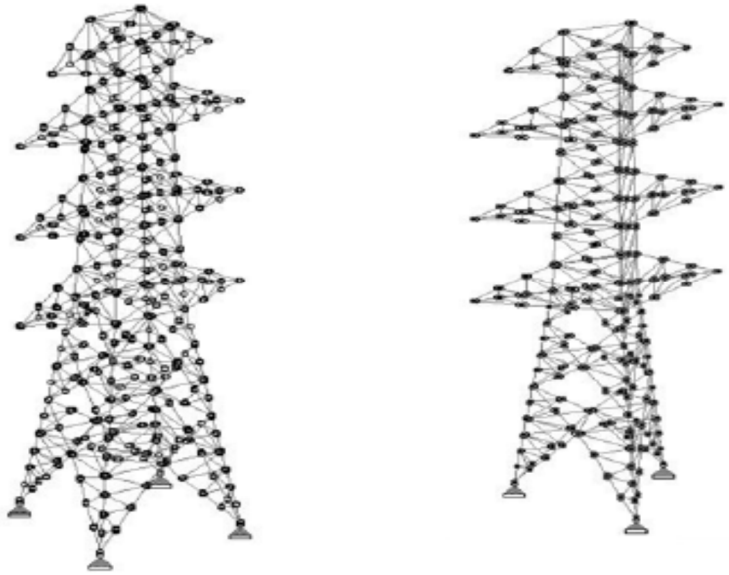

Figure 1: Four legged and three legged tower

II. REVIEW OF LITERATURE

Addala, G., et al [1] studied that when designing transmission towers with conventional geometries and conductor arrangements the engineer has many design codes and guides available. For the study purpose the data available for 220 KV transmission line tower. The body of a typical single circuit tower subjected to the different load combinations is considered for the parametric study of the effect of the parameters on the weight of tower.

Al-Bermani, F.G. et al [2] studied about a three-nodded isoperimetric cable element having three translational and a torsional degree-of-freedom at each node is developed to model a conductor. Support insulator strings and remote conductor spans are represented by linear static springs. A transmission line's interactions with a support tower are modeled through the tower's equivalent stiffness at the conductor's suspension point.

Diana, G., et al [5] developed a non-destructive methodology is presented for detecting structural damage in structural systems. The procedure is based on using experimentally measured modes and frequencies in conjunction with vibratory residual forces and a weighted sensitivity analysis to estimate the extent of mass and/or stiffness variations in a structural system.

III. MODELING

The modeling is carried out in the STAAD software, mentioned as follows.

1) *Model-I:* (Height-22m, Location-Mysore)
2) *Model-II:* (Height-22m, Location-Nasik)
3) *Model-III:* (Height-22m, Location-Nagpur)
4) *Model-IV:* (Height-22m, Location-Jamshedpur)
5) *Model-V:* (Height-22m, Location-Guwahati)

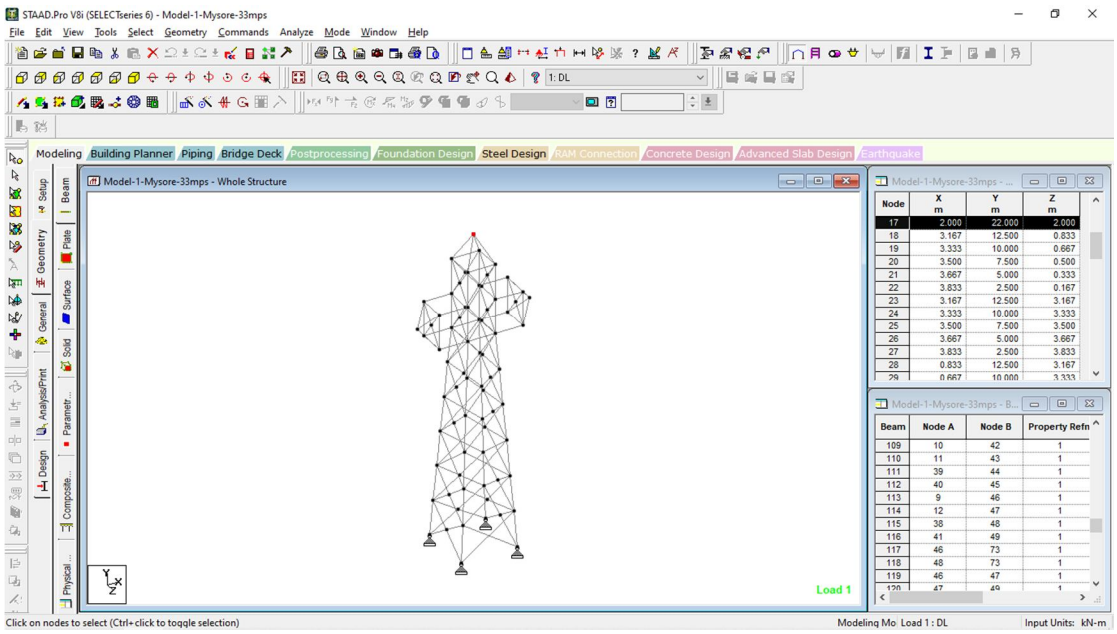

Figure 2: Elevation of Model-I

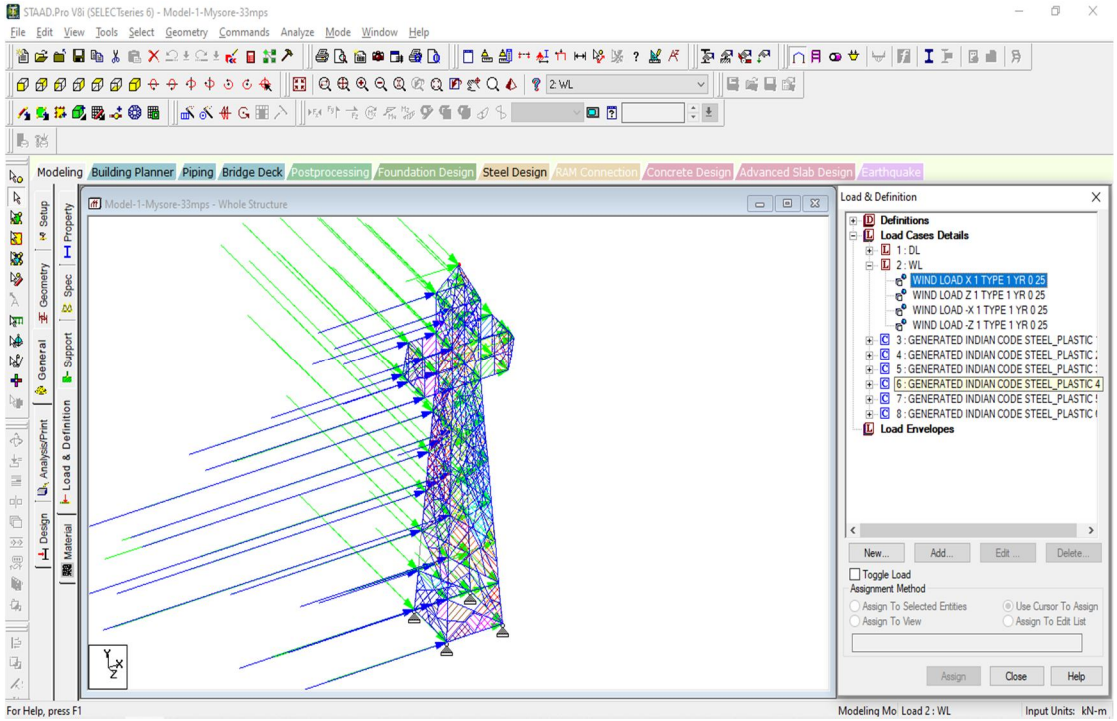

Figure 3: Load Distribution of Model-I

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IV. RESULTS

The analysis is carried out in STAAD software and the results in terms of shear force, bending moment and other parameter is obtained as follows.

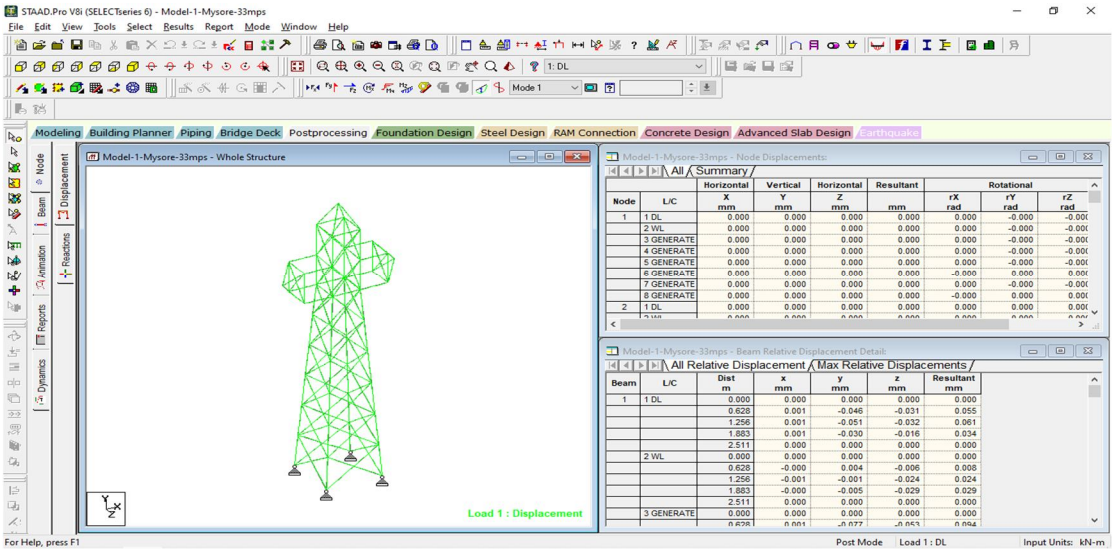

Figure 4: Displacement of model-I

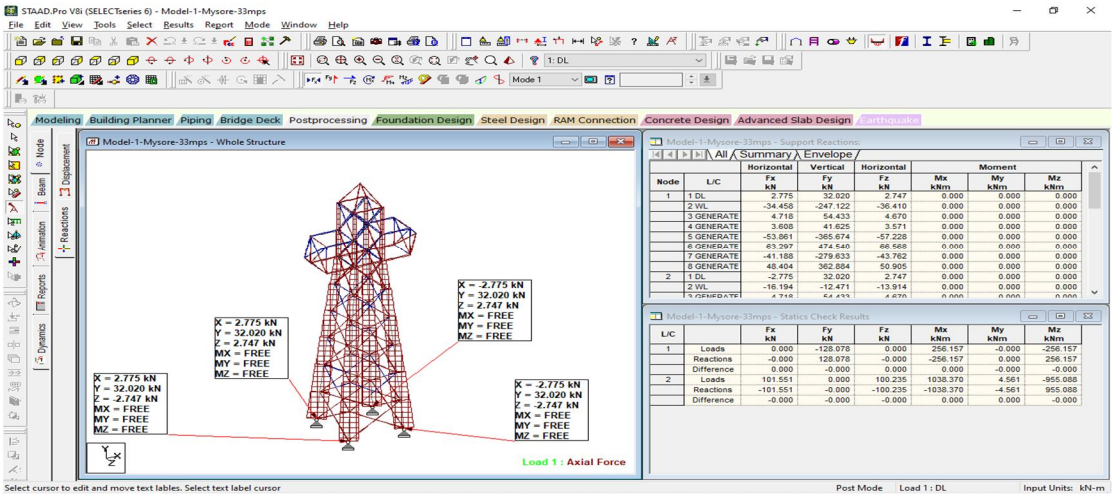

Figure 5: Axial Force of model-I

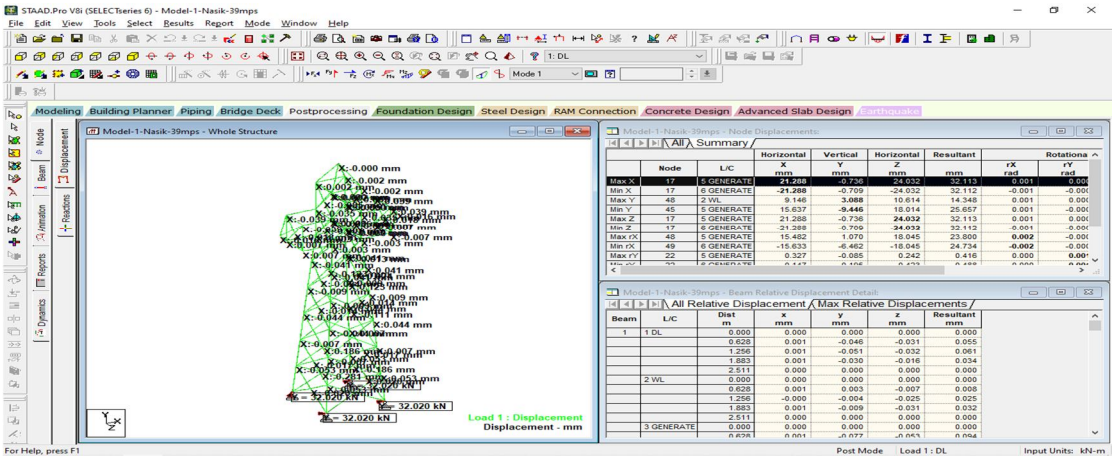

Figure 6: Displacement of model-II

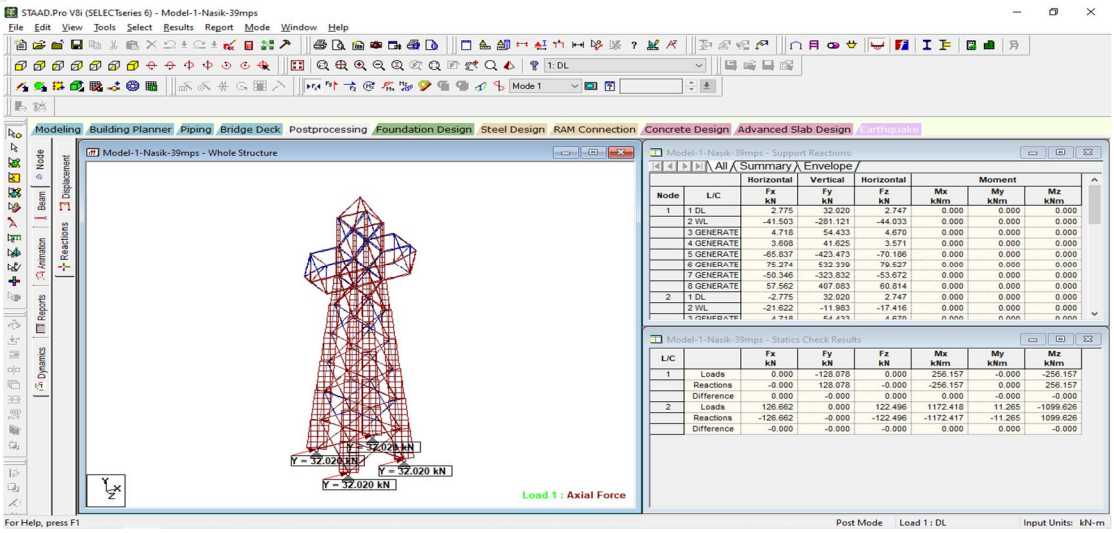

Figure 7: Axial force of model-II

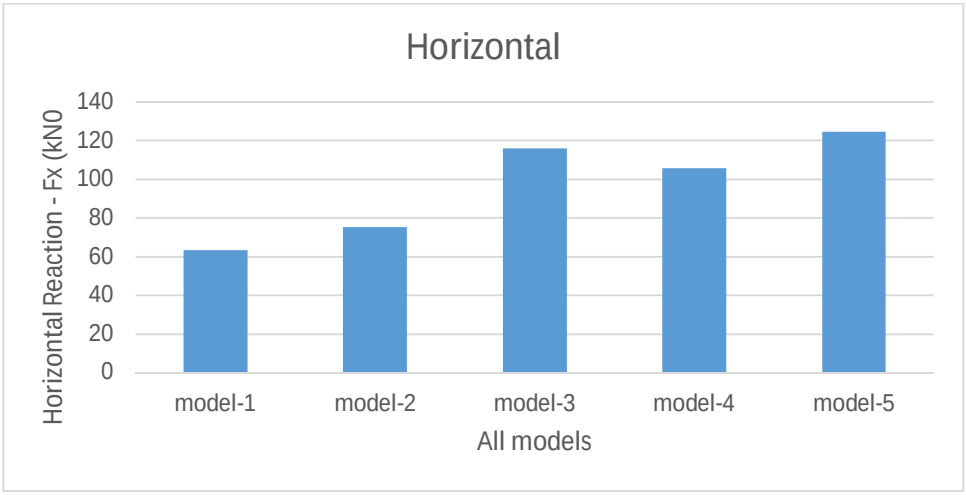

Figure 8: Horizontal displacement (X-dir) of all models

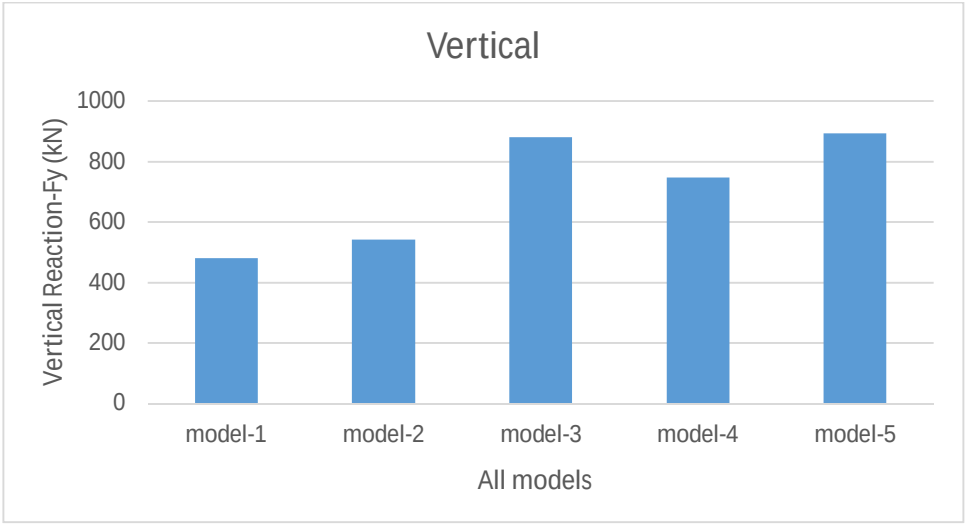

Figure 9: Vertical Reaction (Fy) of all models

V. CONCLUSION

The conclusions from the above study are as follows:

A. From the above graph the horizontal displacement (X-direction) is found to be maximum for the model-5 as compared to the other models. As the height goes on increasing the displacement found to be increasing. Also as the wind speed is increasing the displacement is also found to be increasing.

B. From the above graph the Vertical displacement is found to be maximum for the model-5 as compared to the other models. As the height goes on increasing the displacement found to be increasing. Also as the wind speed is increasing the displacement is also found to be increasing.

C. From the above graph the horizontal displacement (Z-direction) is found to be maximum for the model-5 as compared to the other models. As the height goes on increasing the displacement found to be increasing. Also as the wind speed is increasing the displacement is also found to be increasing.

D. Maximum frequency found for the mode shape -12 comparative to the other modes

E. The model-8 gives maximum displacement, reactions and the forces as comparative to the other models

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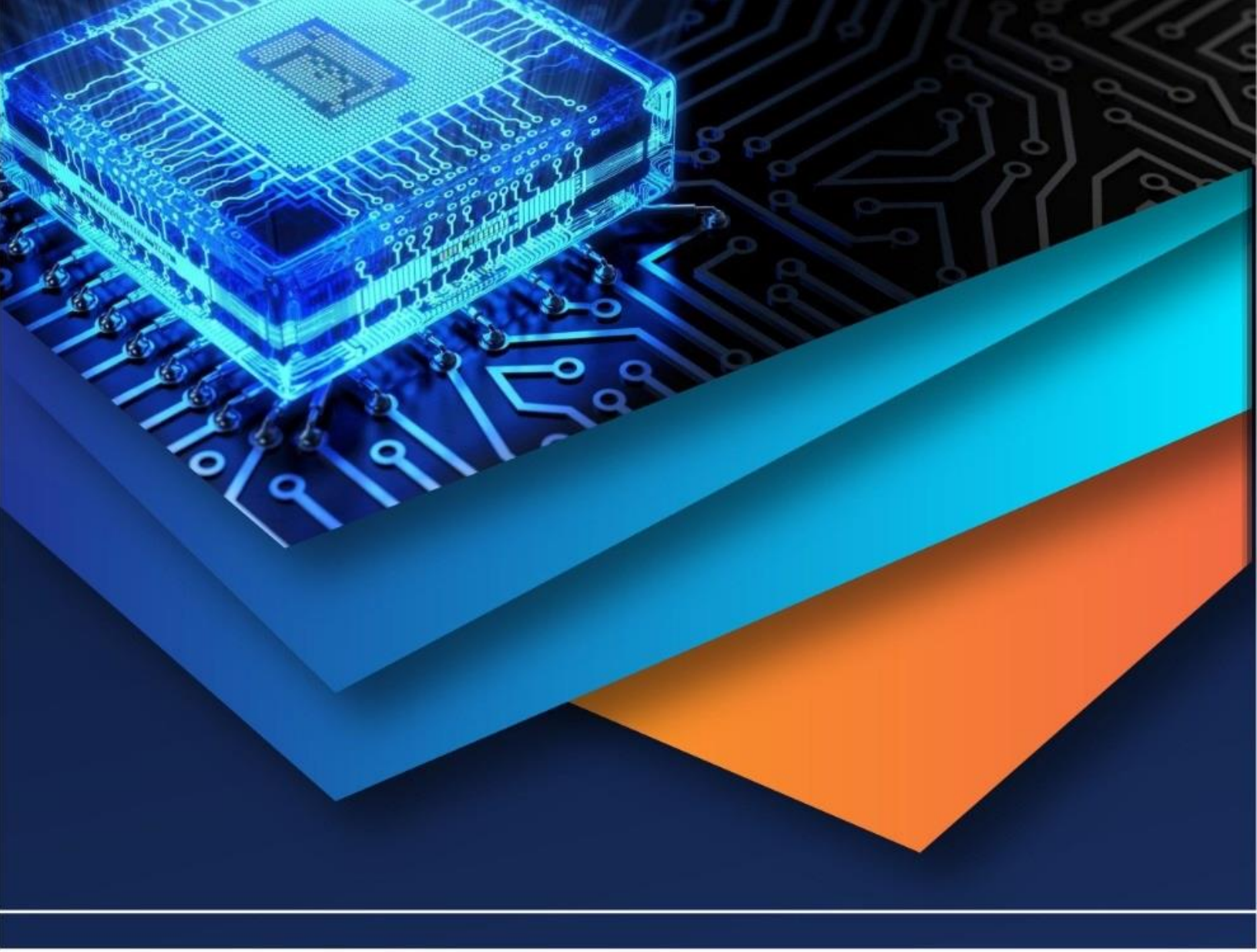

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