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Structural Analysis of Tall RC Chimney with different Thickness

Sujata Charhate[1], Prof. Ganesh Deshmukh[2]
[1]*P.G. Student,* [2]*Assistant Professor, Department of Civil Engineering, Pankaj Laddhad Institute of Technology and Management Studies, Buldhana, Maharashtra, India*

Abstract: ***Reinforced chimneys are usually designed for loads formed due to seismic effect and wind. Therefore, it is inevitable to analyze the dynamic response of the chimney due to the effects of earthquakes and wind loads. Due to changes in chimney geometry, structural analysis, such as earthquake response and wind fluctuations, becomes more critical. High RC chimneys are an important part of the main industries and power plants. Damage to chimneys leads to the closure of industry and power plants. The chimney achieves a simultaneous decrease in the concentration of pollutants. From the above results it is observed that the membrane stress it is observed that the moments are found to be more in the top plate as compared bottom plate and the observed value is 425 N/mm2. Also it is observed that the Von-Mis stress it is observed that the moments are found to be more in the top plate as compared bottom plate and the observed value is 375 N/mm2.***
Keywords: Chimney, tall, RCC and analysis

I. INTRODUCTION

A chimney is a means by which the exhaust gases are discharged at high altitudes, so that after dilution due to atmospheric turbulence, their concentration and the concentration of their fixed solid particles are within acceptable limits to reach the earth. The chimney achieves a simultaneous decrease in the concentration of a number of pollutants, such as sulfur dioxide, ash, etc., And being very reliable, he does not need waiting. While this is a clear merit, it is good to remember that the chimney is not a complete solution to the problem of pollution control.

The popular material for the construction of the chimney in the beginning was steel and brick. As the chimney grew, a stage was reached when the brick became uneconomical and was replaced by steel chimneys and reinforced concrete chimneys. In recent years, reinforced concrete has greater resistance to wind vibration and foundation settlement.

II. REVIEW OF LITERATURE

K.S.Babu Narayan et al (2006) In critical cross-section (ie 1/2 to 1/3 of the height above) by wind methods maximum than by wind methods. This is due to the fact that in critical terms the impact of vortex emissions on the structure of the chimney will be greater. The shear force, bending moment and deflection in the transverse wind methods are the same in both zones for this reason, the calculation of the transverse wind is directly proportional to the weight of the chimney, frequency and forms of its mode.

Sreerath S (2015) "Nonlinear dynamic analysis of the system of industrial chimneys for loading hurricanes", this document presents the results of nonlinear dynamic analysis to assess the structural pile of performance and the matte base that supports a high concrete chimney stack of 350 feet for hurricane wind loads. Wind tunnel tests were performed to develop a wind load time history at the height of the chimney.

Reddy K. R. C (2011) discusses the implications of different chimney lifting profiles, ie., uniform chimney, conical chimney and uniform chimney. The dynamic behavior of the chimney due to wind load in wind zone I and seismic analysis were studied. The height for this study ranged from 150 to 300 m.

III. MODELING

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

1) Model-I (Concrete chimney-height 100 m, 0.25 m thickness)
2) Model-II (Concrete chimney-height 100 m, 0.3 m thickness)
3) Model-III (Concrete chimney-height 100 m, 0.4 m thickness)
4) Model-IV (Concrete chimney-height 100 m, 0.45 m thickness)
5) Model-V (Concrete chimney-height 100 m, 0.5 m thickness)

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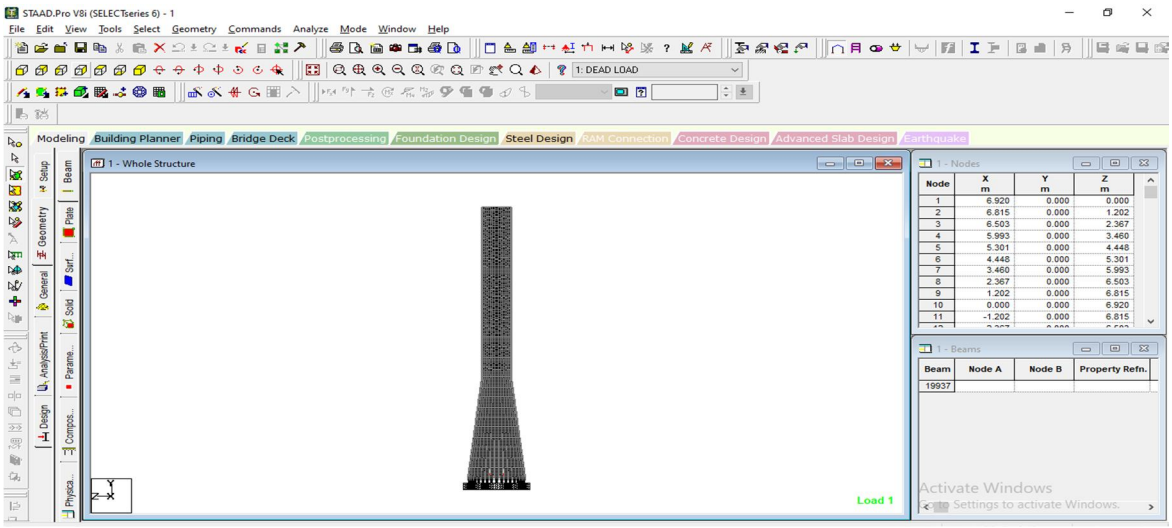

Figure 1: Side view of chimney

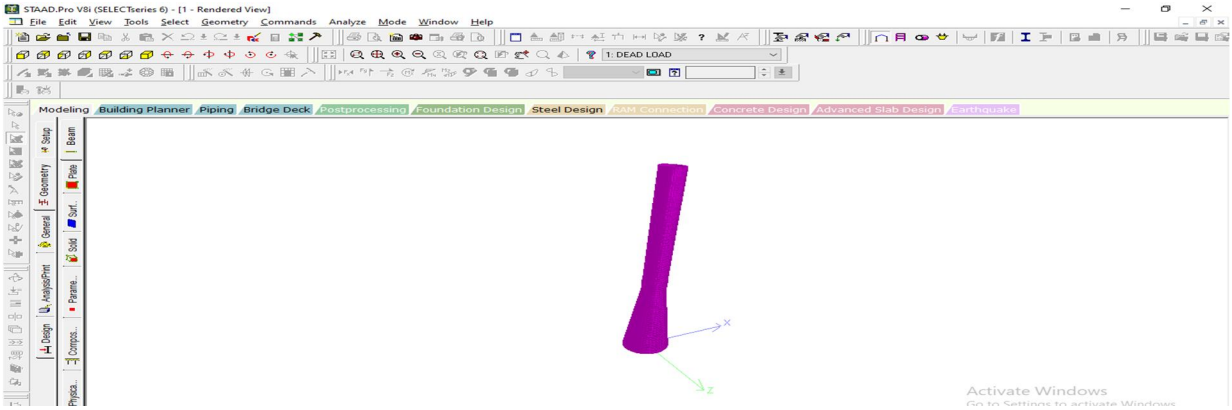

Figure 2: 3D view of model of chimney

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.

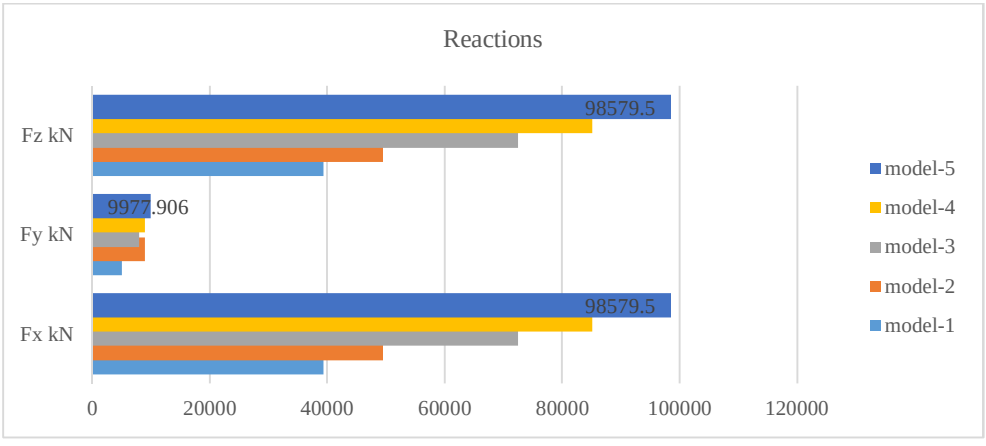

Figure 3 : Reactions of models

From the above figure it is observed that the reactions (Fx, Fy & Fz) it is observed that the reactions are found to be more in the model-5 as compared to other models and the observed value is 98579.5 kN.

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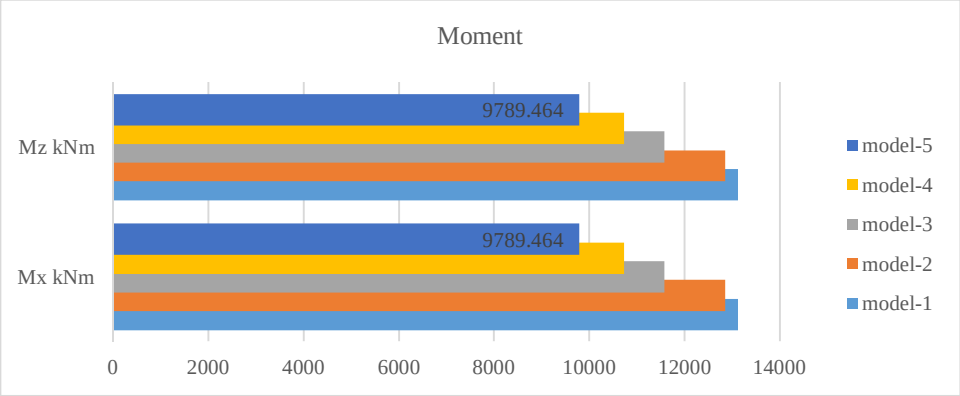

Figure 4: Moment of models

From the above figure it is observed that the moments (Mx & Mz) it is observed that the moments are found to be more in the model-1 as compared to other models and the observed value is 13000 kNm.

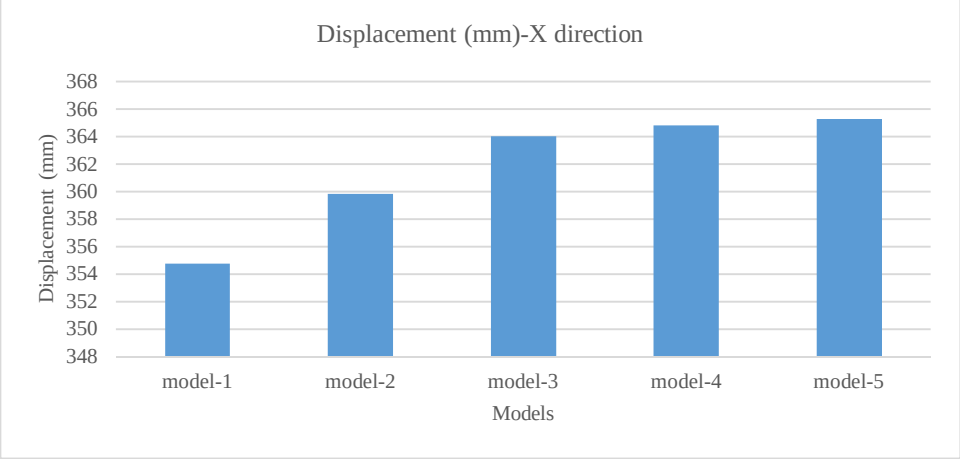

Figure 5: Displacement (X-direction) of the models

From the above figure it is observed that the Displacement (X-direction) it is observed that the moments are found to be less in the model-1 as compared to other models and the observed value is 354 mm.

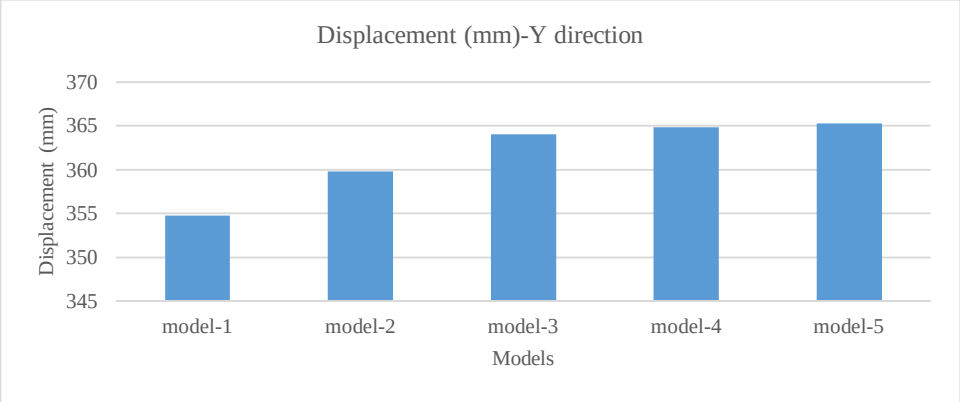

Figure 6: Displacement (Y-direction) of the models

From the above figure it is observed that the Displacement (Y-direction) it is observed that the moments are found to be more in the model-5 as compared to other models and the observed value is 365 mm.

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Figure 7: Displacement (Z-direction) of the models

From the above figure it is observed that the Displacement (Z-direction) it is observed that the moments are found to be less in the model-1 as compared to other models and the observed value is 355 mm.

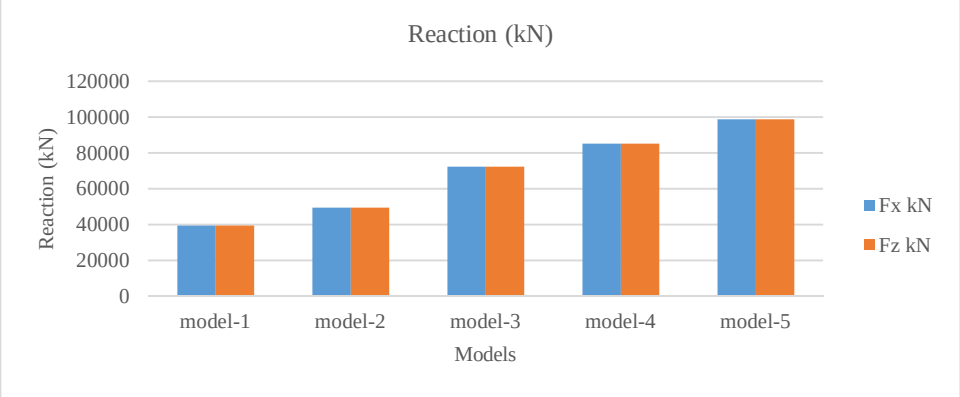

Figure 8: Reactions (Fx & Fz) of the models

From the above figure it is observed that the Reactions (Fx & Fz) it is observed that the moments are found to be less in the model-1 as compared to other models and the observed value is 40000 kN, it goes on increasing upto model-5.

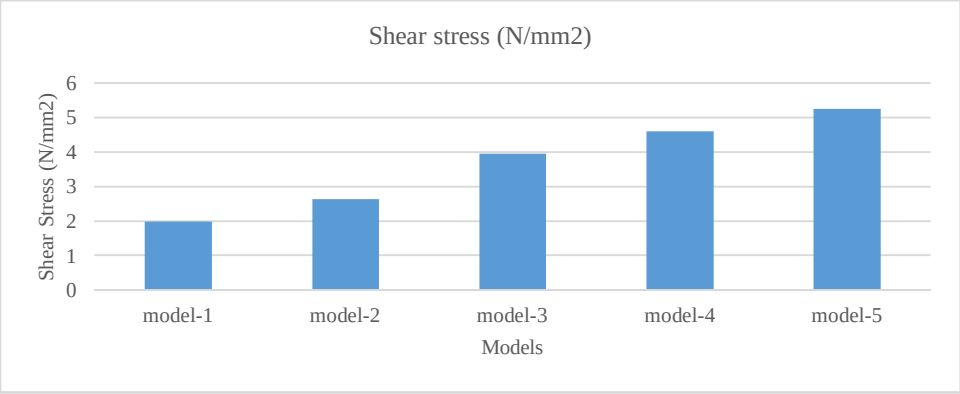

Figure 9: Shear stress of the models

From the above figure it is observed that the Shear stress it is observed that the moments are found to be less in the model-1 as compared to other models and the observed value is 2 N/mm^2, it goes on increasing upto model-5.

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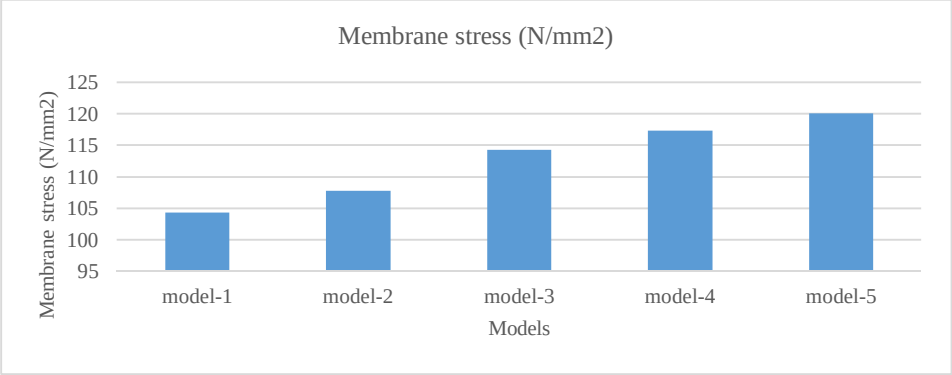

Figure 10: Membrane stress of the models

From the above figure it is observed that the membrane stress it is observed that the moments are found to be less in the model-1 as compared to other models and the observed value is 104 N/mm^2, it goes on increasing upto model-5.

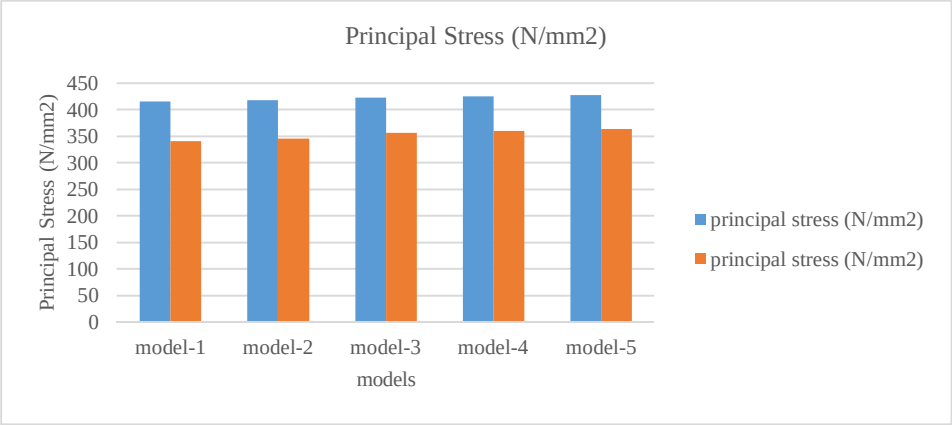

Figure 11: Principal stress of the models

From the above figure it is observed that the membrane stress it is observed that the moments are found to be more in the top plate as compared bottom plate and the observed value is 425 N/mm^2.

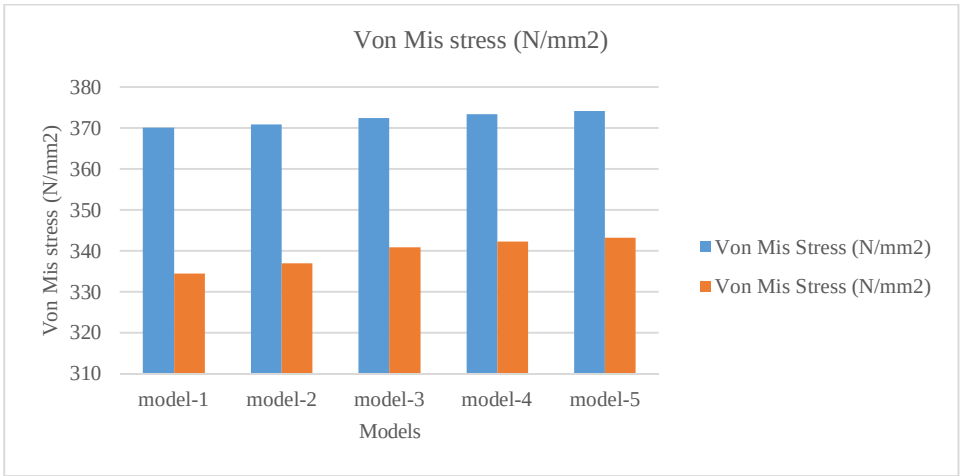

Figure 12: Von-Mis stress of the models

From the above figure it is observed that the Von-Mis stress it is observed that the moments are found to be more in the top plate as compared bottom plate and the observed value is 375 N/mm^2.

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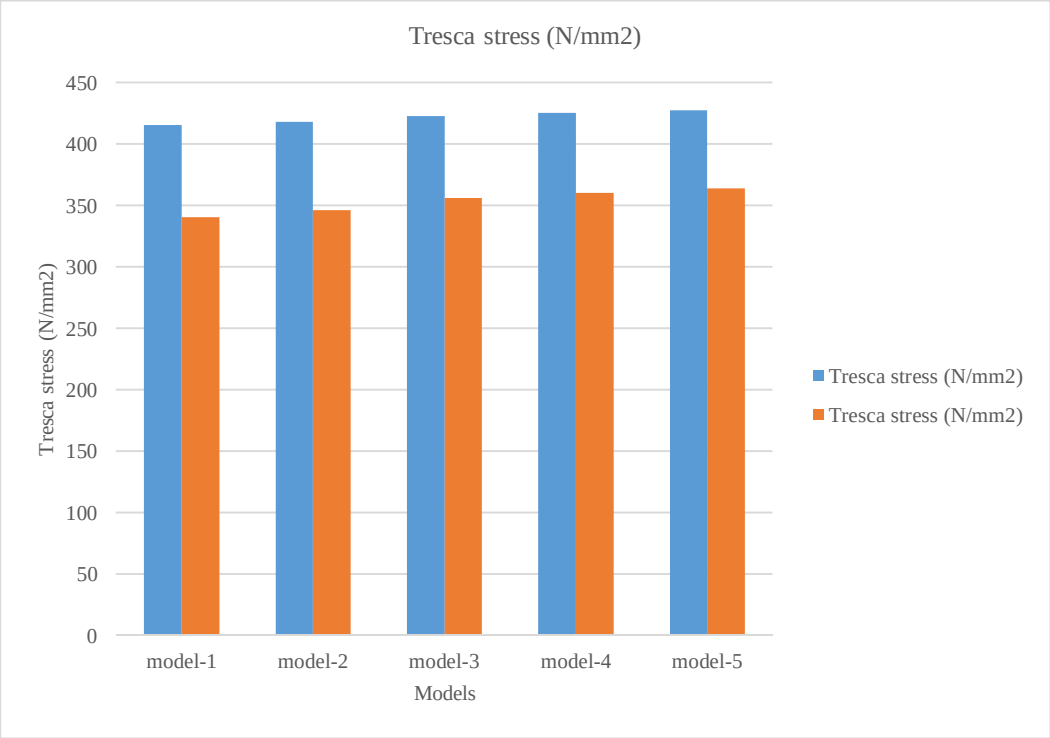

Figure 13: Tresca stress of the models

From the above figure it is observed that the Tresca stress it is observed that the moments are found to be more in the top plate as compared bottom plate and the observed value is 425 N/mm^2.

V. CONCLUSION

The conclusions from the above study are as follows:

A. From the above results it is observed that the reactions (Fx, Fy & Fz) it is observed that the reactions are found to be more in the model-5 as compared to other models and the observed value is 98579.5 kN. Also it is observed that the moments (Mx & Mz) it is observed that the moments are found to be more in the model-1 as compared to other models and the observed value is 13000 kNm.

B. From the above results it is observed that the Displacement (X-direction) it is observed that the moments are found to be less in the model-1 as compared to other models and the observed value is 354 mm. Also it is observed that the Displacement (Y-direction) it is observed that the moments are found to be more in the model-5 as compared to other models and the observed value is 365 mm.

C. From the above results it is observed that the Displacement (Z-direction) it is observed that the moments are found to be less in the model-1 as compared to other models and the observed value is 355 mm. Also it is observed that the Reactions (Fx & Fz) it is observed that the moments are found to be less in the model-1 as compared to other models and the observed value is 40000 kN, it goes on increasing upto model-5.

D. From the above results it is observed that the Shear stress it is observed that the moments are found to be less in the model-1 as compared to other models and the observed value is 2 N/mm2, it goes on increasing upto model-5. Also it is observed that the membrane stress it is observed that the moments are found to be less in the model-1 as compared to other models and the observed value is 104 N/mm2, it goes on increasing upto model-5.

E. From the above results it is observed that the membrane stress it is observed that the moments are found to be more in the top plate as compared bottom plate and the observed value is 425 N/mm2. Also it is observed that the Von-Mis stress it is observed that the moments are found to be more in the top plate as compared bottom plate and the observed value is 375 N/mm2.

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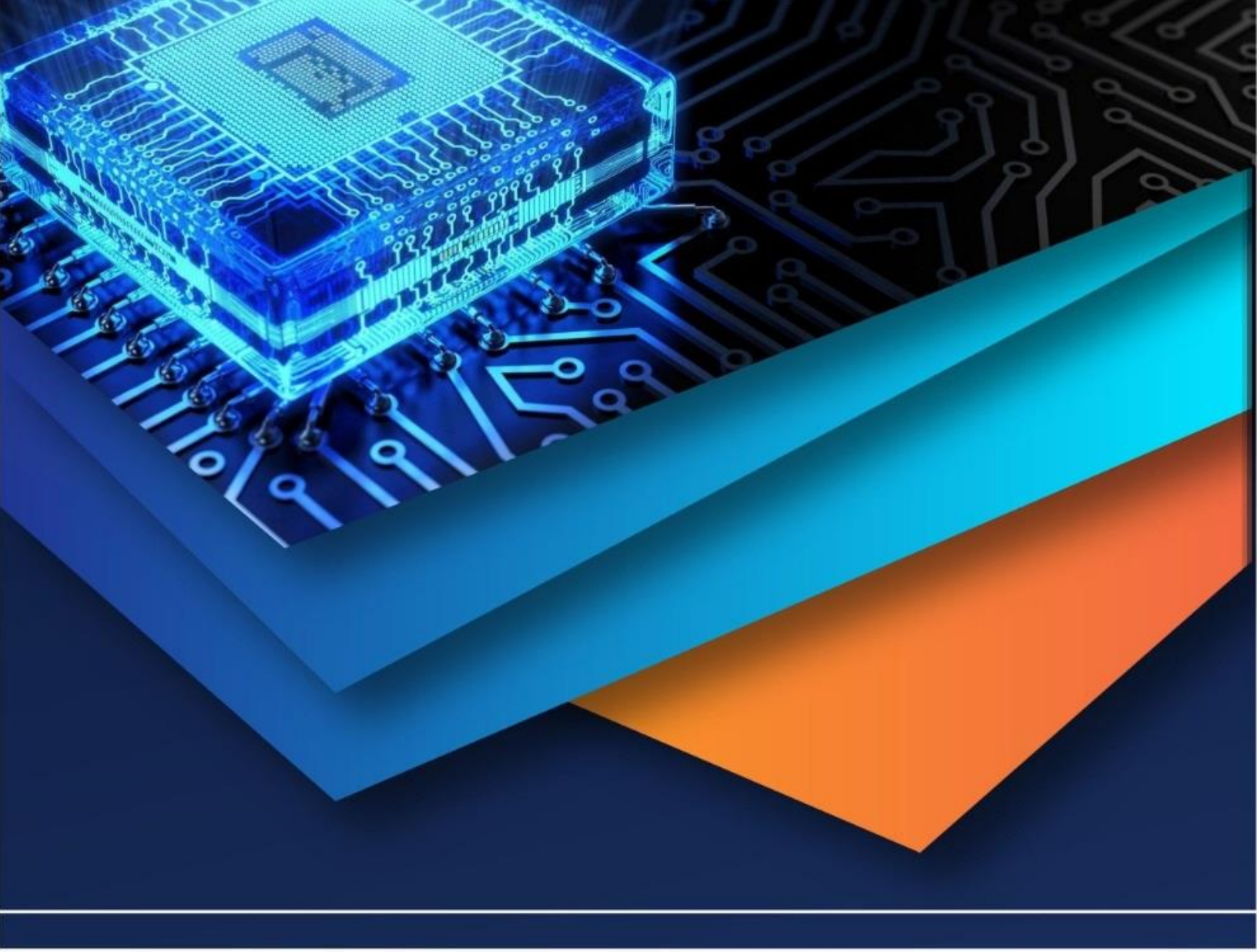

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