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Analysis of RC Structure with Floating Column in Different Seismic Zones using ETABS

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Abstract: ***A floating column is supposed to be a vertical member starting from foundation level and transferring the load to the ground. In India many of the buildings are constructed with floating column. Floating columns are adopted in order to provide spacious hall and other amenities.***
The seismic forces generated at different floor level of the building need to be carried out to the foundation by shortest possible way which may not be the case when floating columns are provided. Providing floating columns may satisfy some of the functional requirements but structural behaviour changes abruptly due to provisions of floating columns. In this study analysis of RC structures with floating column in different seismic zones using ETABS is studied. The building is modelled using ETABS software.
The models are G+10 RC buildings whereas, one is regular structure and others are structures with floating columns provided in different stories. In this thesis parameters such as storey displacement, storey shear and storey drift are computed using ETABS and the values extracted are compared with each other.
Keywords: Floating column, Seismic forces, Etabs, Storey displacement, Storey drift, Storey shear.

I. INTRODUCTION

Modern multi-storey buildings are constructed with
Irregularities such as mass irregularity, plan irregularity and vertical irregularity. And it is observed that most of RC structures with these kind of irregularities are undesirable for seismic activity. As all know earthquake is most destructive of all natural disaster and safety measures must be considered while construction. In this study we have chosen floating column irregularity which is stiffness irregularity comes under vertical irregularity.
Stiffness irregularity is nothing but, a storey in which lateral stiffness is less than 60-70 percent of that of above or less than 70-80 percent of the average lateral stiffness of the three storeys above. In the thesis 4 models i.e, regular structure, structure with floating column in 1st floor, structure with floating column in 4th floor and structure with floating column in 9th floor are modelled using ETABS software and parameters such as, storey displacement, storey shear, storey drift are computed from ETABS and compared one another.

A. Floating Columns

The floating column is a vertical member which rests on beam and transfers loads from beam to the column below it. Now a days multi storey buildings constructed for the purpose of residential, commercial, industrial etc., with an open ground storey has become a common feature. For the sake of parking, the ground storey is kept free without any constructions, except for the columns which transfer the building weight to the ground. For a hotel or commercial building, where the lower floors contain banquet halls, conference rooms, and large interrupted space is required for the movement of people or vehicles.

II. OBJECTIVES

To study the seismic behaviour of RC structure with floating column in different seismic zones to tabulate the parameters such as:-

A. To study the behaviour of the building with floating column in 2 and 3 seismic zones.
B. To study the storey displacement of building with floating column in comparing with regular building.
C. To study the storey drift of building with floating column in comparing with regular building.
D. To study the storey shear of building with floating column in comparing with regular building.

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III. STRUCTURAL DATA AND MODELLING

A. *Structural Data*

PARTICULARS	MODEL-01	MODEL-02	MODEL-03	MODEL-03
Number of storey	G+10	G+10	G+10	G+10
Size of column(mm)	300*450	300*450	300*450	300*450
Size of beam(mm)	230*450	230*450	230*450	230*450
Zone	2 and 3	2 and 3	2 and 3	2 and 3
Soil type	2	2	2	2
Height of building	33.5	33.5	33.5	33.5
Position of floating column	-	2^{st} floor	5^{th} floor	10^{th} floor
Type of structure	Moment resisting frame	Moment resisting frame	Moment resisting frame	Moment resisting frame

B. *Materials Properties*

Name	E MPa	v	Unit Weight Kn/m^3	Design Strengths
HYSD500	200000	0	76.9729	Fy=500MPa, Fu=545MPa
M25	25000	0.2	24.9926	Fc=25MPa

C. *Models*

1) Model: 01(Regular structure)

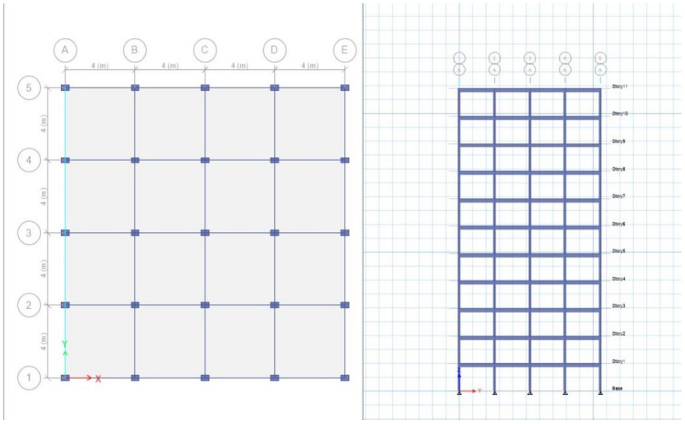

Fig-01: Regular structure

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2) *Model:* 02 (Structure with floating column in 2nd floor)

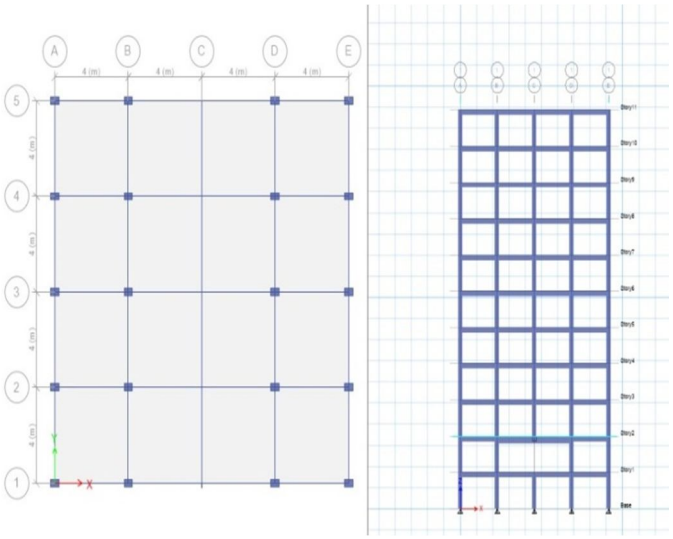

Fig-02: Structure with floating column in 2nd floor

3) *Model:* 03 (Structure with floating column in 5th floor)

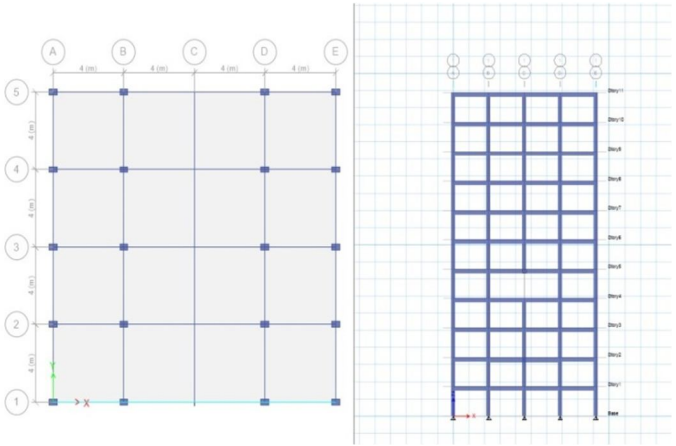

Fig-03: Structure with floating column in 5th floor

4) *Model:* 04 (Structure with floating column in 10th floor)

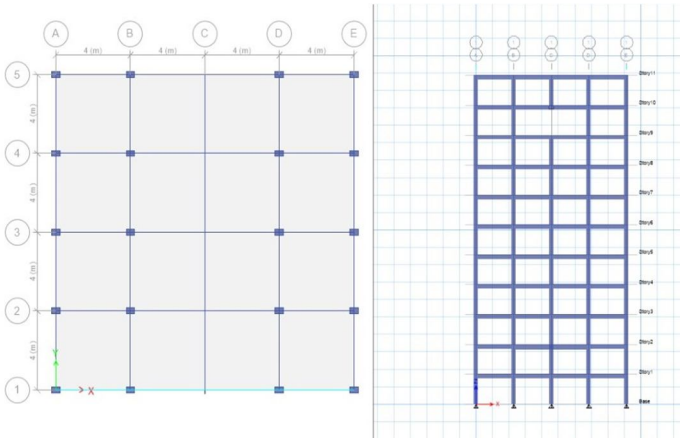

Fig-04: Structure with floating column in 10th floor

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IV. RESULT AND DISCUSSION

A. *Storey Displacement*

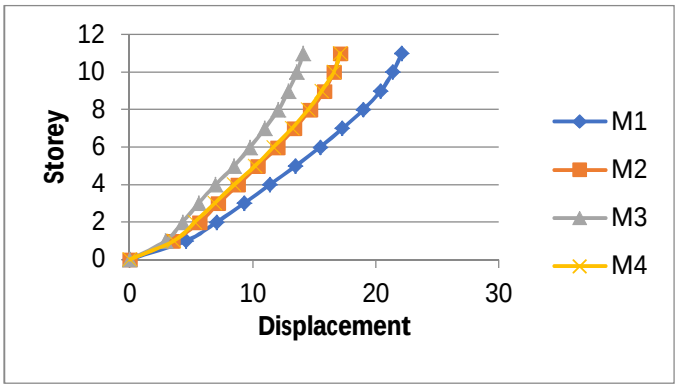

Fig-05: storey vs storey displacement in X direction in zone 2

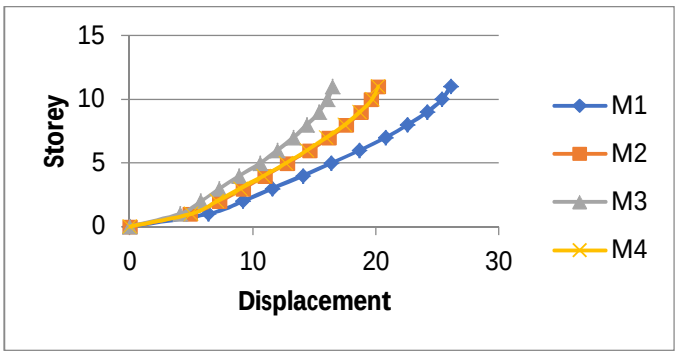

Fig-06: storey vs storey displacement in Y direction in zone 2

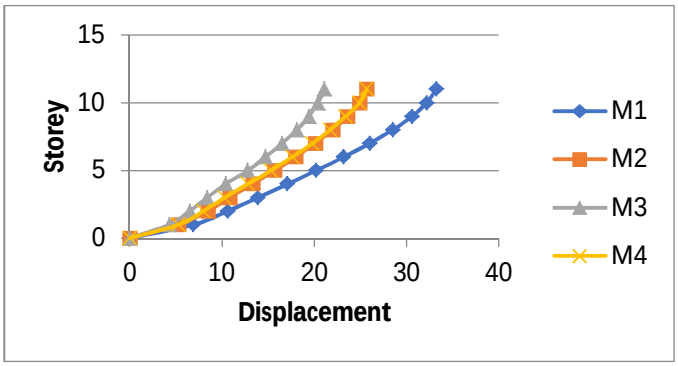

Fig-07: storey vs storey displacement in X direction in zone 3

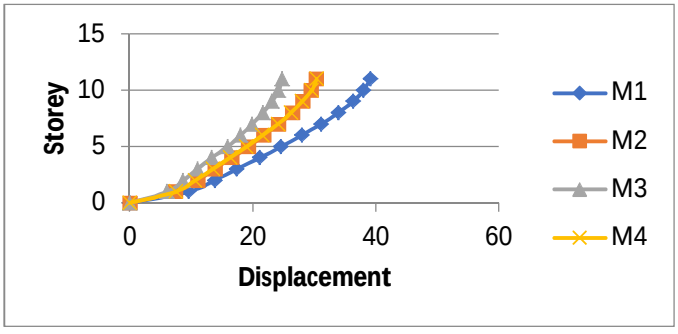

Fig-08: storey vs storey displacement in Y direction in zone 3

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B. Storey Drift

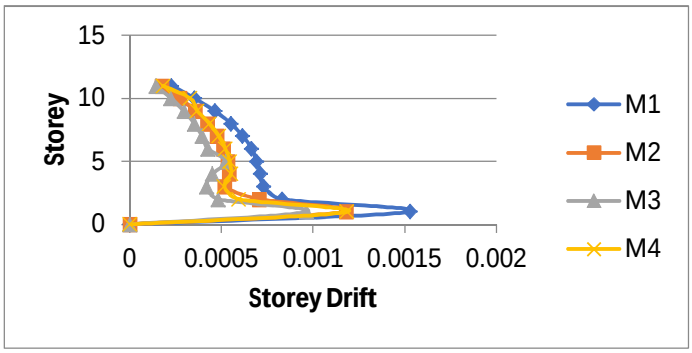

Fig-09: storey vs storey drift in X direction in zone 2

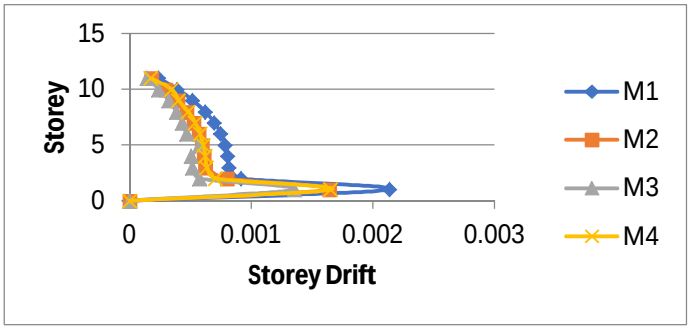

Fig-10: storey vs storey drift in Y direction in zone 2

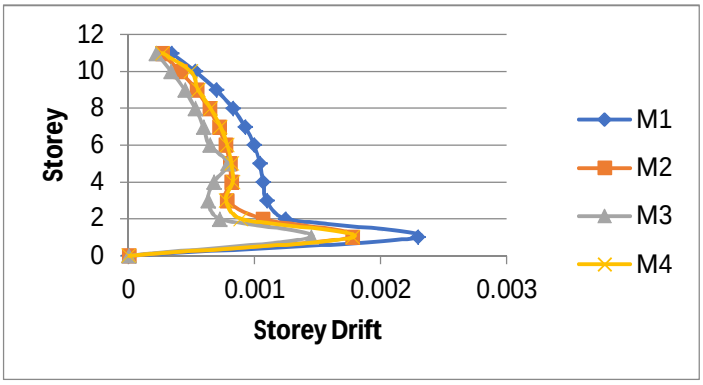

Fig-11: storey vs storey drift in X direction in zone 3

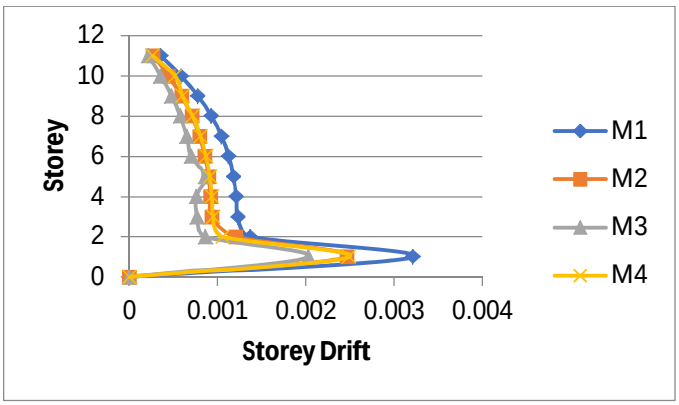

Fig-12: storey vs storey drift in Y direction in zone 3

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C. Storey Shear

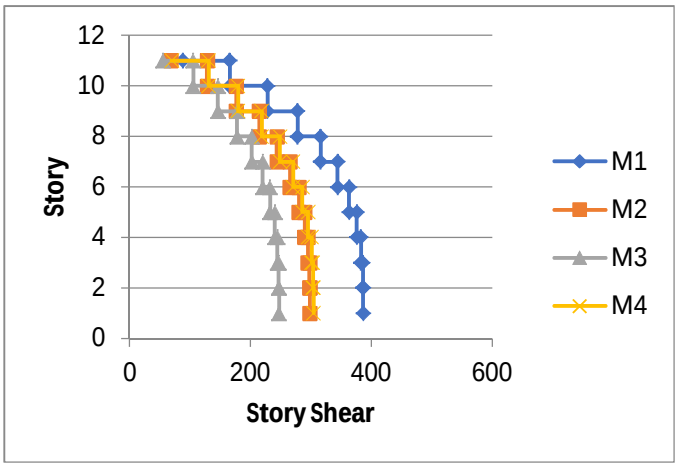

Fig-13: storey vs storey shear in X direction in zone 2

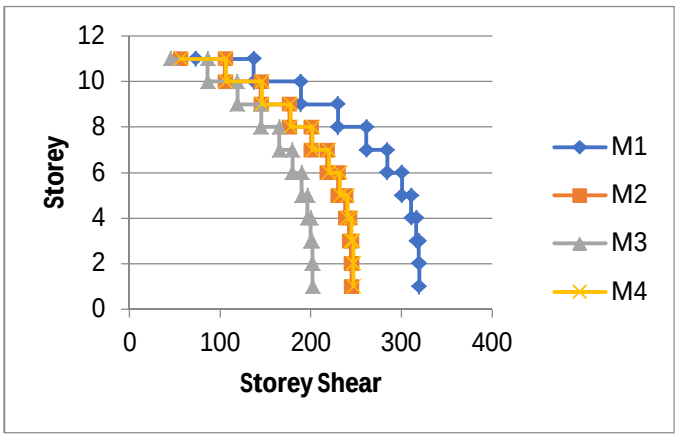

Fig-14: storey vs storey shear in Y direction in zone 2

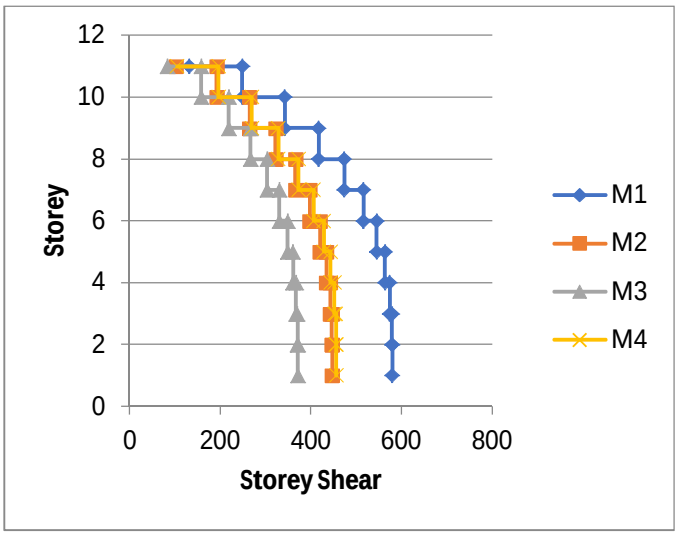

Fig-15: storey vs storey shear in X direction in zone 3

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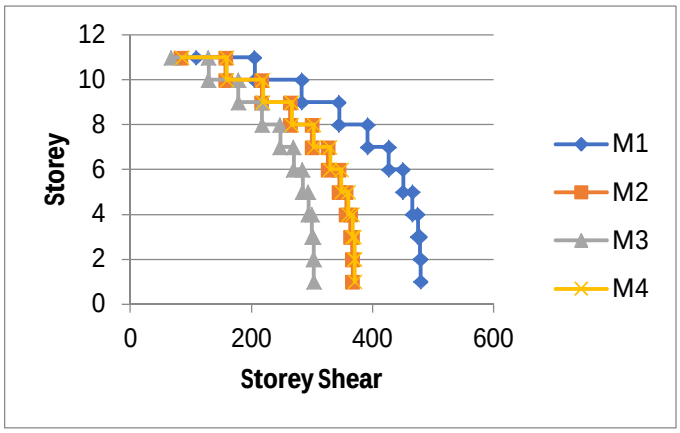

Fig-16: storey vs storey shear in Y direction in zone 3

V. CONCLUSION

Comparative analysis of G+10 storey building with four different models and two different zones (zone 2 and zone 3). ETABS software is used for modelling and analysis of the structures. Analysis results like storey displacement, storey drift and storey shear are presented here. Following are the conclusions drawn from the study.

A. The storey displacement is more in zone 3 compared to zone 2 and model 3 in both zone shows less displacement compared to all other models.
B. The storey drift is more in zone 3 compared to zone 2 and model 3 in both zone shows less drift compared to all other models.
C. The storey shear is more in zone 3 compared to zone 2 and model 3 in both zone shows less shear compared to all other models.
D. Model shows more results as the zone increases and model 3 in both zone shows less results compared to other models.

From the above study we can conclude that as the seismic zone increases the values for storey displacement, drift and shear also increases. Since the structures are safe in zone 2 and 3 one can prefer floating column buildings in these zones. But, when we look into the higher zone that is zone 5 it may not be safe building floating column structures. If there is necessary of floating column structures in zone 5 we need to take precautionary measures in order to resist seismic load by implementing earthquake resisting techniques such as providing dampers, shear walls and so on.

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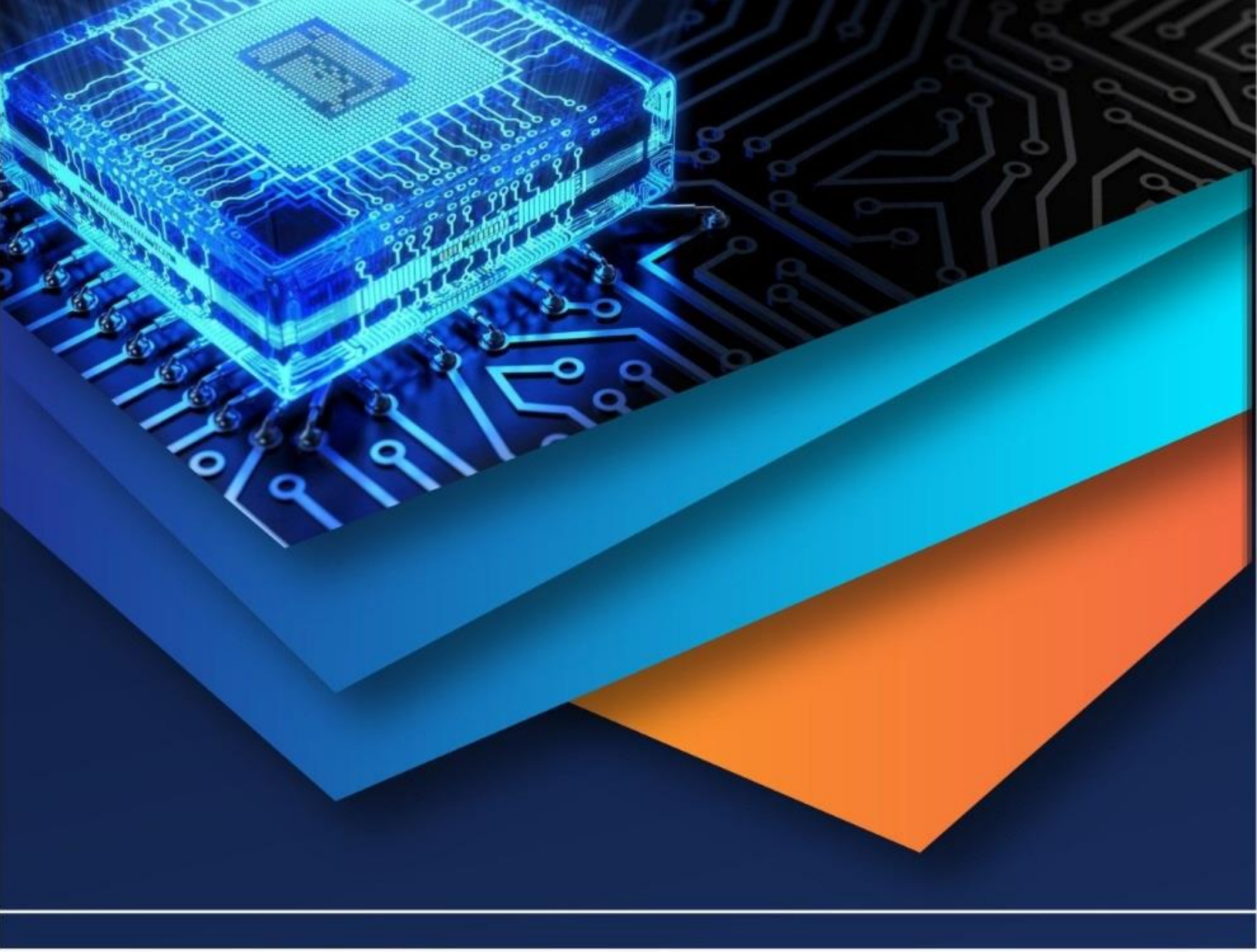

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