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# Seismic Analysis of Multistorey Floating Column Building with Lateral Load Resisting System

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***Abstract:*** ***The primary object of the review is to know the way behaving of multistory building with floating column as for the shear wall and bracings under seismic power for various zone i.e zone 3, zone 4, zone 5. The review is done for G+7 building utilizing ETABS programming. Contrasting the outcome got in various cases and closing which kind of system provides more effectiveness.***

***Keywords: Floating column building, Bracings, Shear wall, Storey displacement, Storey drift, Base shear***

## I. INTRODUCTION

Floating columns are the structures which have columns that relaxation on beams, beam being guide to the columns on the first slab and above the structures. The bottom ground is saved open by means of the use of minimum wide variety of columns which might take the whole load on the way to come from beams to the basement columns and switch it to the floor. The floating column systems has a bonus that greater space is to be had because of the restrict use of columns without any obstacles as properly as it cannot maintain seismic forces and can get damage

The column is a vertical member beginning from basis stage and moving the weight to ground. The time period floating column is a vertical element which at its decrease stage rests on a beam that is a horizontal member. The beam switch the weight to different column below. There are many initiatives wherein floating columns are followed in particular above the floor ground, in order that extra open space is to be had inside the floor floor and these open space may be utilized as birthday party corridor, meeting hall and parking motive.

## II. LITERATURE REVIEW

Neha pawer et. All(2021) carried on ‘‘Effect of floating column on buildings subjected to seismic forces’’-in this paper they analyzed the G+8 building with floating column in ETABS. The analysis carried by changing the upper storey height, removing exterior and interior columns and also changing the size of the column. They conclude that theinterior placement of floating column reduces the seismic hazard of structure as compared to outer periphery floating columns. After increasing the diameter of the column the displacement is reduced.

Maneesh Ahirwar, Rahul Satbhaiya(2020) carried on ‘‘Reliability analysis of multistorey building with floating column by Staad.pro-V8i’’- in this paper they analyzed G+2 building with and without floating column in Staad Pro software by static analysis as well as dynamic analysis method. Under static loading, found that both building were safe and under dynamic loading floating column structure was unsafe. With increasing the quantity of concrete by 27.40% and reinforcement of structures by 15.05% the building safe under dynamic loading also.

Gulchaman Khan and Mayur Singi(2019) carried out research on ‘‘Seismic Analysis of Multistorey Building Having Floating Column’’-in this paper they analyzed the 8 storey, 12 storey and 16 storey building with the floating column furnished with and without shear position for zone V by using the software ETABS 2016 and concluded that providing the shear wall, the storey displacement can be reduced compared to without shear wall. By providing shear wall at all the four junction makes the building total stable in lateral displacement as well as storey drift.

Kiran Kumar Gaddad and Vinayak Vijapur(2018) carried on ‘‘Comparative study of multistorey building with and without floating column and shear walls ’’- in this paper they analysed the G+20 building, with four different structures using ETABS software. They concluded that the building with shear wall possess better performance, lesser displacement, more strength compare to other models.

Payal k Jayswal, Amey R Khedikar(2018) carried on‘‘ Seismic analysis of multistorey building with floating column and regular column’’-in this paper they analysed the G+6 building with floating column and regular column in STAAD Pro software. They conluded that by introducing the floating column to the building, moment increases in both x and y direction. Axial force as well as shear also increases in both the direction and may increases the displacement at various nodes.

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*A. Objectives*

*1)* To model the multistorey building i.e G+7 with floating column in ETAB software.
*2)* Seismic design of the multistorey building with floating column.
*3)* To analyse the multistorey building with floating column.
*4)* To study the structural response of the building models with respect to storey displacement, storey drift and base shear.
*5)* To compare the structural response building with floating column with respect to different zones.
*6)* To provide the bracing and shear wall for multistorey building with floating column.
*7)* To compare the structural response of multistory building with floating column with respect to bracings and shear wall.
*8)* To compare the structural response of floating column building with respect to the lateral load resisting structures.

## III. METHODOLOGY

*1)* *Step 1:* Seismic design of a multi storey building i.e G+7 with the floating column.
*2)* *Step 2:* Modelling of the G+7 building with the floating column for zone 3, floating column building for zone 4 and floating column building for zone 5 in ETABS software
*3)* *Step 3:* Analyzing the above model or the building in the software and taking the values of storey drift, storey displacement and base shear.
*4)* *Step 4:* Again modeling the G+7 floating column building by providing bracing for zone 3, zone 4 and zone 5.
*5)* *Step 5:* Analyze the models of floating column building with bracings and take the values of storey drift, storey displacement and base shear.
*6)* *Step 6:* Modeling the G+7 floating column building by providing the shear wall for zone 3, zone 4amd zone 5.
*7)* *Step 7:* Analyze the models with shear wall and take the values of storey drift, displacement and base shear.
*8)* *Step 8:* Compare the values of different models and plot the graph foe respective ones.
*9)* *Step 9:* Concluding the system which provides more efficiency.

*A. Response Spectrum Analysis*

Response spectrum plot gives the greatest relocation, most extreme speed, greatest speed increase or some other boundaries to the regular recurrence exposed to indicated excitation for straight single degree of
freedom system oscillators.
These plots are exposed to explicit damping and it changes as damping changes.
To decide the most extreme response of a straight single degree of freedom system from the accessible spectral graph, for indicated seismic tremor excitation , one necessities just to know the natural frequency of the system and damping.
The response spectrum is involving the similar standards as time history.
Just rather than time history, it is greatest upside of the response.At the point when the time history profile isn't free for a specific dynamic event, then the response spectrum used.
Response spectrum analysis provides more moderate outcome than time history.

*B. Building Description*

*1)* The building is of 20m length in x direction, 20m length in y direction with the storey height of 3m.
*2)* Spacing of column is 5m
*3)* The building consists of 8 storey i.e G+7 storey
*4)* Size of the beam is 300*500mm
*5)* Size of the column is 300*600mm
*6)* Size of the slab is 200mm
*7)* Size of the shear wall is 200mm
*8)* Grade of concrete is M30 grade of steel is Fe415

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Parameters considered for the building design

| Parameters | Type/ value |
|---|---|
| structure type | floating column building |
| resisting system | bracing, shear wall |
| area of structure | 400m$^2$ |
| live load | 5 KN/m$^2$ |
| importance factor | 1 |
| R | 3 |
| Zone | 3, 4, 5 |
| Floor finish | 1 KN/m$^2$ |
| Soil type | Medium |
| Density of concrete | 25KN/m$^2$ |

*C. Model description*

Model 1- Building provided floating column for zone 3
Model 2- Building provided floating column for zone 4
Model 3- Building provided floating column for zone 5
Model 4- Floating column building with bracings for zone 3
Model 5- Floating column building with bracings for zone 4
Model 6- Floating column building with bracings for zone 5
Model 7- Floating column building with shear wall for zone 3
Model 8- Floating column building with shear wall for zone 4
Model 9- Floating column building with shear wall for zone 5

**ETABS models**

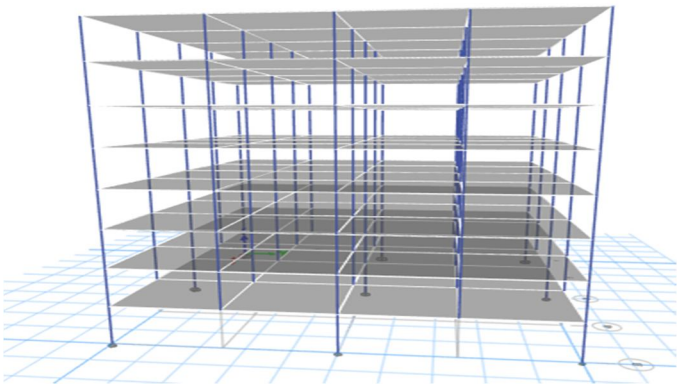

Fig.1 Model 1, Model 2, Model 3

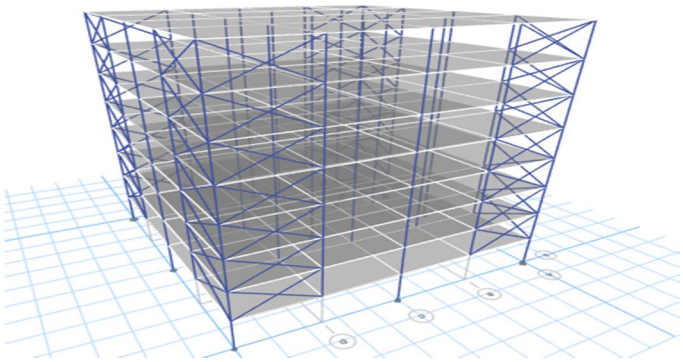

Fig.2 Model 4, Model 5, Model 6

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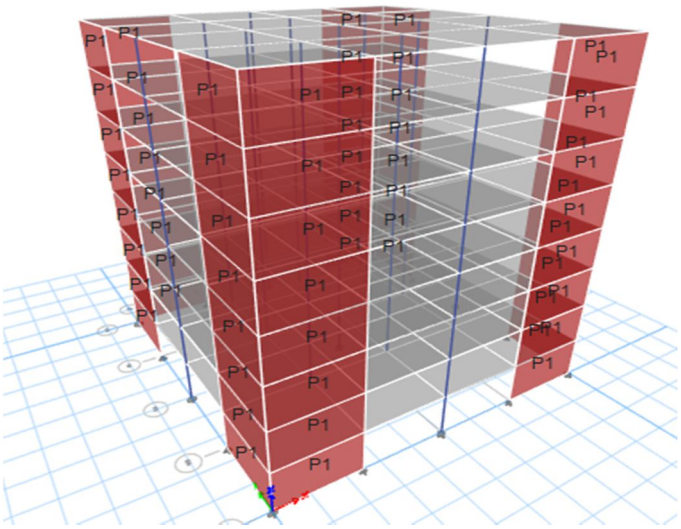

Fig.3 Model 7, Model 8, Model 9

## IV. RESULT AND DISCUSSION

### A. *Storey Displacement*

| | STOREY DISPLACEMENT IN mm | | | |
|---|---|---|---|---|
| **Story** | Model 1 | Model 2 | Model 3 | Model 4 |
| Story8 | 95.496 | 106.816 | 123.797 | 66.342 |
| Story7 | 91.095 | 101.735 | 117.695 | 60.954 |
| Story6 | 84.418 | 94.043 | 108.479 | 54.886 |
| Story5 | 75.438 | 83.769 | 96.265 | 48.338 |
| Story4 | 64.304 | 71.143 | 81.403 | 41.333 |
| Story3 | 51.19 | 56.414 | 64.25 | 33.947 |
| Story2 | 36.408 | 39.965 | 45.302 | 26.396 |
| Story1 | 20.555 | 22.473 | 25.349 | 18.429 |
| Base | 0 | 0 | 0 | 0 |

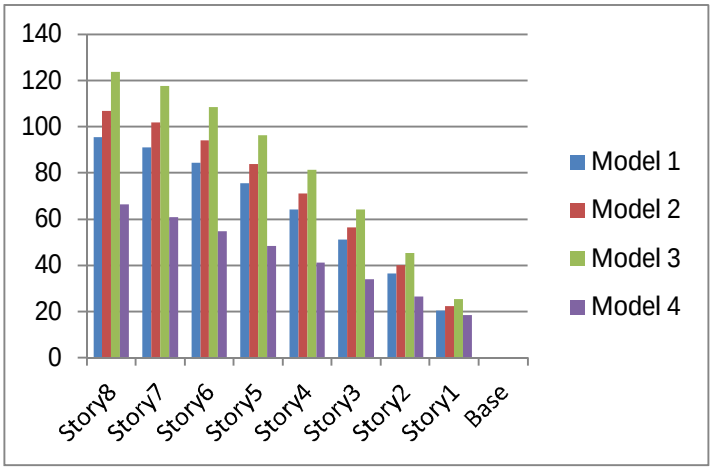


Fig.4 storey v/s displacement

| Story | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 |
|---|---|---|---|---|---|
| Story8 | 74.205 | 86.001 | 13.001 | 14.935 | 17.837 |
| Story7 | 68.091 | 78.797 | 11.198 | 12.849 | 15.325 |
| Story6 | 61.199 | 70.669 | 9.285 | 10.635 | 12.659 |
| Story5 | 53.774 | 61.928 | 7.361 | 8.411 | 9.986 |
| Story4 | 45.855 | 52.637 | 5.465 | 6.225 | 7.366 |
| Story3 | 37.536 | 42.919 | 3.667 | 4.161 | 4.903 |
| Story2 | 29.065 | 33.068 | 2.057 | 2.323 | 2.721 |
| Story1 | 20.183 | 22.816 | 0.789 | 0.884 | 1.027 |
| Base | 0 | 0 | 0 | 0 | 0 |

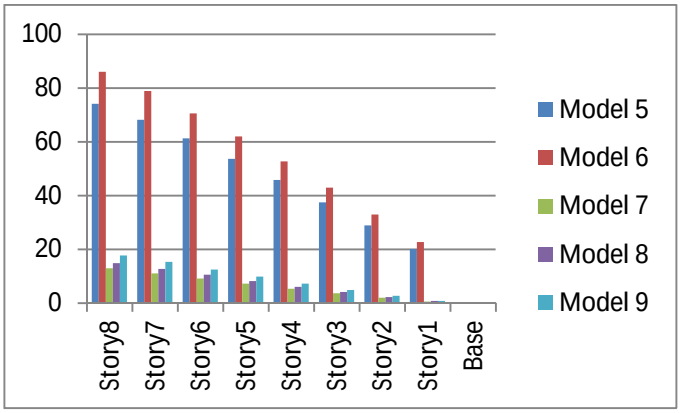


Fig.5 storey v/s displacement

*B. Storey Drift*

| | STOREY DRIFT | | | |
|---|---|---|---|---|
| Story | Model 1 | Model 2 | Model 3 | Model 4 |
| Story8 | 0.001469 | 0.001696 | 0.002037 | 0.001829 |
| Story7 | 0.002226 | 0.002564 | 0.003072 | 0.002023 |
| Story6 | 0.002993 | 0.003425 | 0.004072 | 0.002183 |
| Story5 | 0.003712 | 0.004209 | 0.004955 | 0.002336 |
| Story4 | 0.004375 | 0.004914 | 0.005722 | 0.002464 |
| Story3 | 0.004947 | 0.005504 | 0.00634 | 0.002538 |
| Story2 | 0.005385 | 0.00594 | 0.006773 | 0.002724 |
| Story1 | 0.006826 | 0.007463 | 0.008418 | 0.006103 |
| Base | 0 | 0 | 0 | 0 |

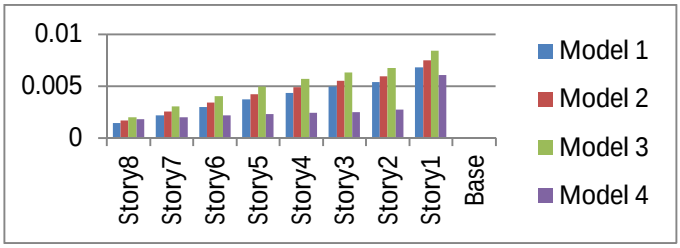


Fig.6 storey v/s storey drift

| Story | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 |
|---|---|---|---|---|---|
| Story8 | 0.002076 | 0.002446 | 0.000618 | 0.000714 | 0.000858 |
| Story7 | 0.002297 | 0.002709 | 0.000638 | 0.000738 | 0.000889 |
| Story6 | 0.002475 | 0.002913 | 0.000642 | 0.000741 | 0.000891 |
| Story5 | 0.002641 | 0.003098 | 0.000632 | 0.000729 | 0.000873 |
| Story4 | 0.002775 | 0.003242 | 0.000599 | 0.000688 | 0.000821 |
| Story3 | 0.002846 | 0.003309 | 0.000537 | 0.000613 | 0.000727 |
| Story2 | 0.003034 | 0.003499 | 0.000433 | 0.000492 | 0.00058 |
| Story1 | 0.006684 | 0.007556 | 0.000263 | 0.000295 | 0.000342 |
| Base | 0 | 0 | 0 | 0 | 0 |

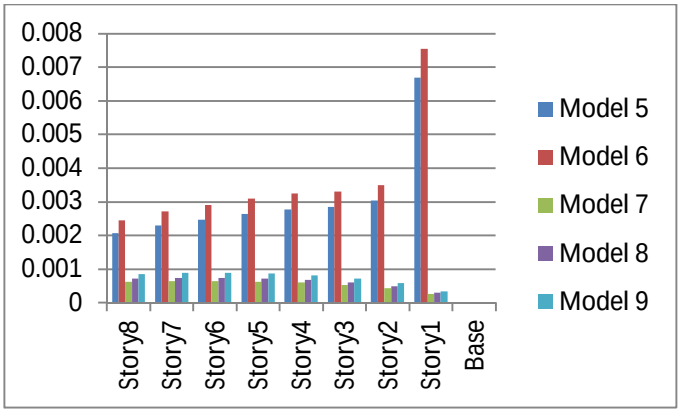


Fig.7 storey v/s storey drift

*C. Base Shear*

| | BASE SHEAR IN KN | | | |
|---|---|---|---|---|
| **Story** | Model 1 | Model 2 | Model 3 | Model 4 |
| Story8 | 921.6725 | 1082.509 | 1323.763 | 926.3918 |
| Story7 | 1782.529 | 2073.794 | 2510.691 | 1794.31 |
| Story6 | 2574.179 | 2961.268 | 3541.902 | 2591.148 |
| Story5 | 3307.269 | 3760.903 | 4441.355 | 3327.841 |
| Story4 | 3992.447 | 4488.67 | 5233.005 | 4015.324 |
| Story3 | 4640.359 | 5160.538 | 5940.808 | 4664.534 |
| Story2 | 5261.653 | 5792.48 | 6588.72 | 5286.404 |
| Story1 | 5866.87 | 6400.305 | 7200.457 | 5891.695 |
| Base | 0 | 0 | 0 | 0 |

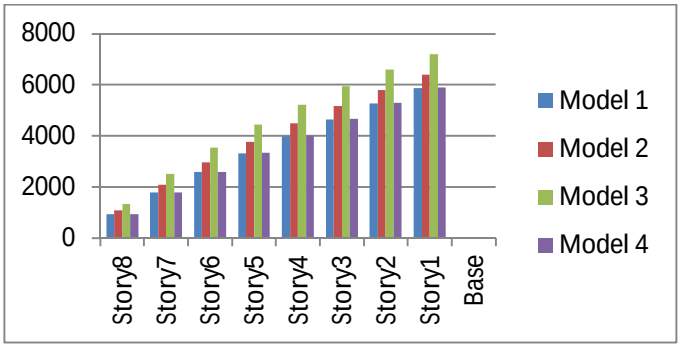


Fig.8 storey v/s base shear

| Story | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 |
|---|---|---|---|---|---|
| Story8 | 1089.588 | 1334.382 | 970.5529 | 1155.829 | 1433.744 |
| Story7 | 2091.465 | 2537.197 | 1902.073 | 2253.109 | 2779.664 |
| Story6 | 2986.722 | 3580.082 | 2745.639 | 3218.458 | 3927.687 |
| Story5 | 3791.761 | 4487.641 | 3514.781 | 4072.172 | 4908.258 |
| Story4 | 4522.986 | 5284.479 | 4223.033 | 4834.549 | 5751.824 |
| Story3 | 5196.8 | 5995.201 | 4883.924 | 5525.886 | 6488.829 |
| Story2 | 5829.607 | 6644.41 | 5510.987 | 6166.481 | 7149.721 |
| Story1 | 6437.542 | 7256.313 | 6117.644 | 6776.466 | 7764.698 |
| Base | 0 | 0 | 0 | 0 | 0 |

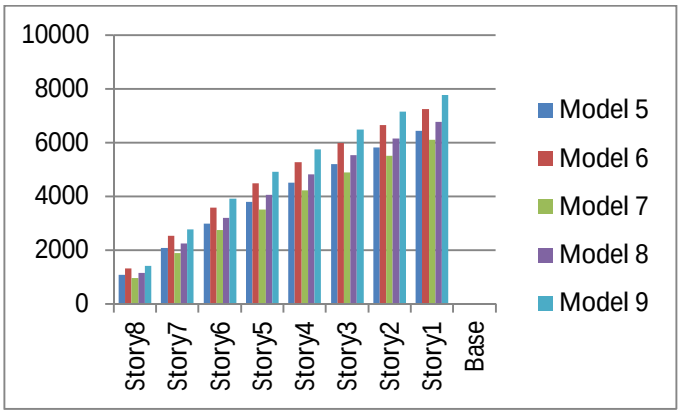


Fig.9 storey v/s base shear

## V. CONCLUSION

*A. Storey Displacement*

*1)* According to the result the floating column building experiences more storey displacement and drift compared to the building with bracing and shear wall

*2)* The result shows that the building experience the 11 % more displacement in zone 4 and 29 % more displacement in zone 5 compared to zone 3.

*3)* It shows that the floating column building with shear wall experiences 85% less displacement and floating column building with bracings experiences 30% less displacement compared to the floating column building.

*B. Storey drift*

*1)* It shows that the building experience the 15 % more drift in zone 4 and 40 % more drift in zone 5 compared to zone 3.

*2)* It shows that the floating column building with shear wall experiences 70% less drift and floating column building with bracings experiences 9% less drift compared to the floating column building.

*C. Base Shear*

*1)* It shows that the building experience the 17% more base shear in zone 4 and 40 % more base shear in zone 5 compared to zone 3.

*2)* It shows that the floating column building with shear wall experiences 5.3% more base shear and floating column building with bracings experiences 0.5% more base shear compared to the floating column building.

*3)* By providing the bracings for G+7 floating column building , the strength increases by 30%.

*4)* By providing the shear wall for G+7 floating column building , the strength increases by 85%.

*5)* By comparing all of this, the study concluded that floating column building with shear wall provides more efficiency compared to the floating column building with bracings as well as building with floating column.

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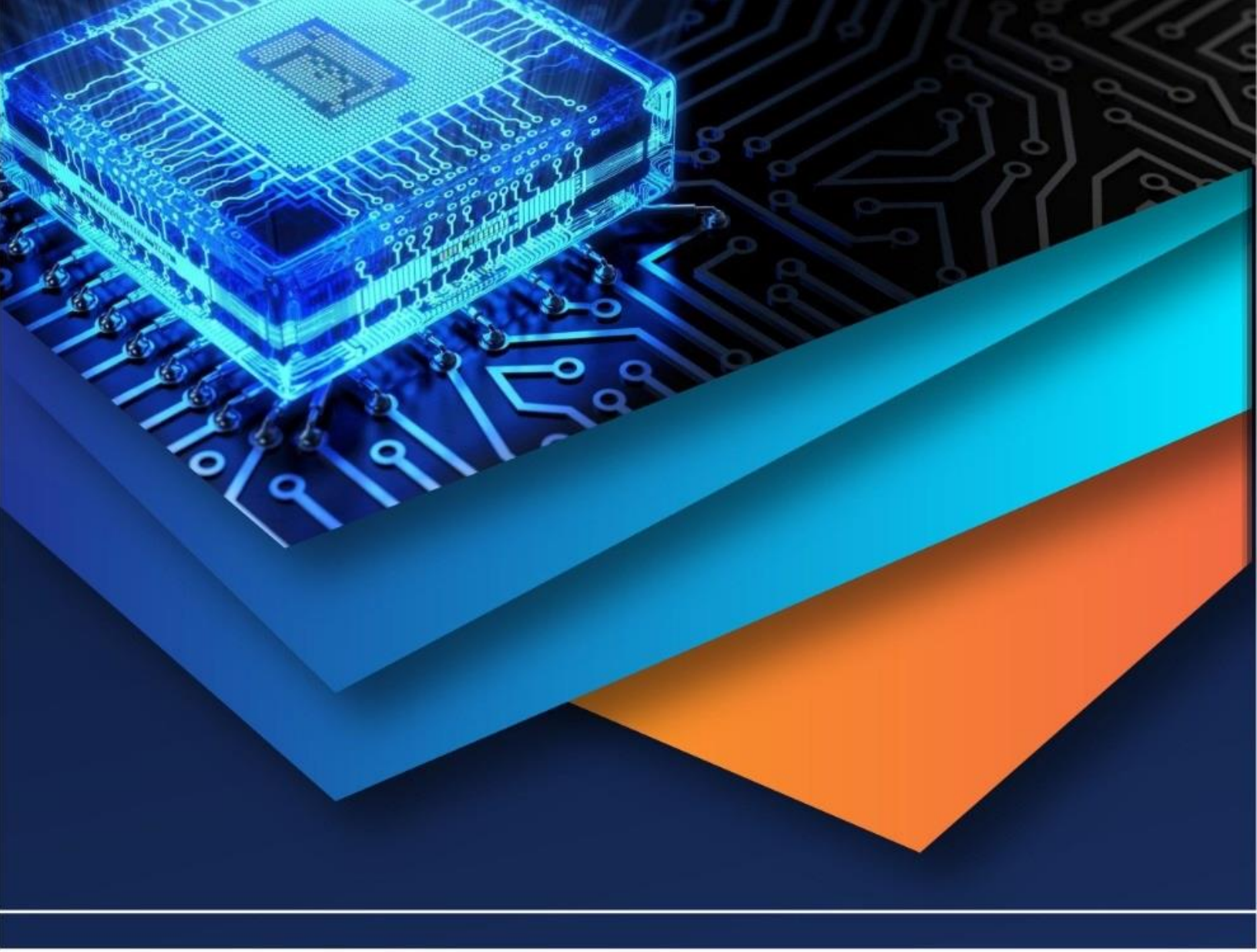

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