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# Comparative Study on Seismic Behaviour of RC Frame Building with and without Staircase

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***Abstract:*** ***In this paper, analysing the effect on building with staircase and without staircase during earthquake have been studied.in design of building, the staircase is generally not analysis & considered. Staircase is secondary Structural member in the RC frame building. Staircase is the one of the main portions of the building. So, Not considering in Analysis & design it causes vulnerable damage in the structure. Here comparing the staircase with different location comparing without staircase to check how seismic effect affect the building when staircase is placed different location and absent of staircase in the building.***
***Keywords: Stair case, Story Drift, Story Displacement, Earthquake, Location.***

## I. INTRODUCTION

Earthquake is an impulsive event and acts quite differently. The force generated by seismic action of earthquake is different than other types of loads, such as, gravity, Dead load, Live load and wind load. It strikes the weakest spot in the whole Structural frame building. Ignorance in structural design and poor quality & maintenance of construction result many weaknesses & faults in the structure member and Structural Building also, thus cause vulnerable damage to life and Structural property of building. In RC frame structural buildings, the primary structural system to resist Lateral & Gravity load are beams and columns. Besides, primary frame structural system, some structural member also contributes to lateral load resistance. These elements fall in the category of secondary systems. Secondary system can be structural secondary like staircase, structural partition etc and non-structural secondary like storage tanks, machinery etc. A special case of structural secondary members which are normally designed for non-seismic force are concrete staircase. In the present study, the effects of staircase on the seismic performance of the RC frame structural buildings of different location of staircase have been studied. in this paper with different structural seismic parameter e.g. Story drift & Story displacement result are studied.

## II. GEOMETRY & PARAMETER

### *A. Geometry Parameter*

TABLE -1: GEOMETRY PARAMETER

| | |
|---|---|
| Total Height of Building | 20m |
| Column Size | 450mmX450mm |
| Beam Size | 230mmX450mm |
| Slab Thickness | 150mm |
| Staircase Slab Thickness | 200mm |
| Story Length in X & Y Direction | 20m |
| Each Story Height | 3m |
| Total Building height | 19.5 m |
| Time Period in X & Y-Direction | 0.3823 Sec. |
| Live load on Slab | 2 $kN/m^2$ |
| Live load on Stair case | 3 $kN/m^2$ |
| Floor Finish on slab | 1.25 $kN/m^2$ |
| Floor finish on Stair case | 2.25 $kN/m^2$ |
| Self-Weight | Auto Calculate by Software (Etabs) |
| Seismic Zone | IV |
| Soil type | Medium |

*B. Geometry View*

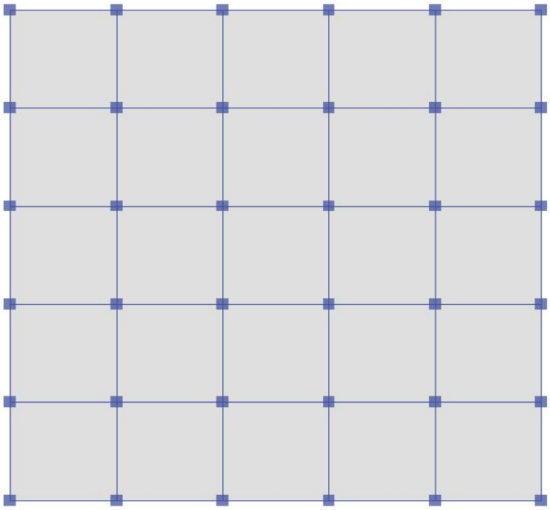

Fig-1: Building without staircase

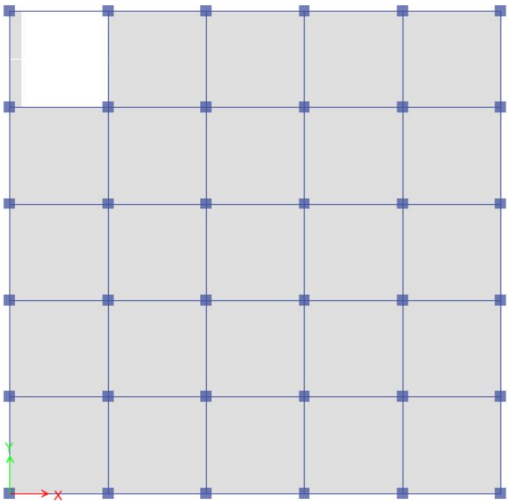

Fig-2: Building with staircase at one corner location

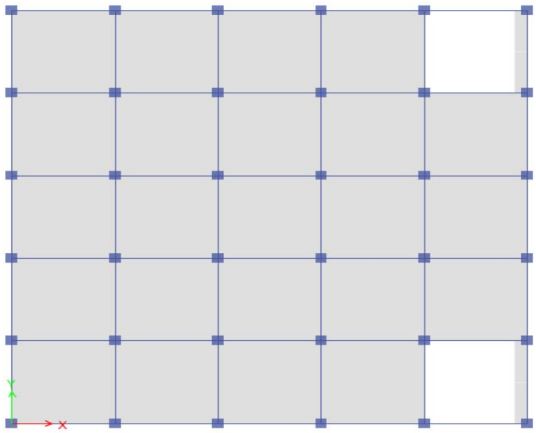

Fig-3: Building with 2-staircase at alternate corner location

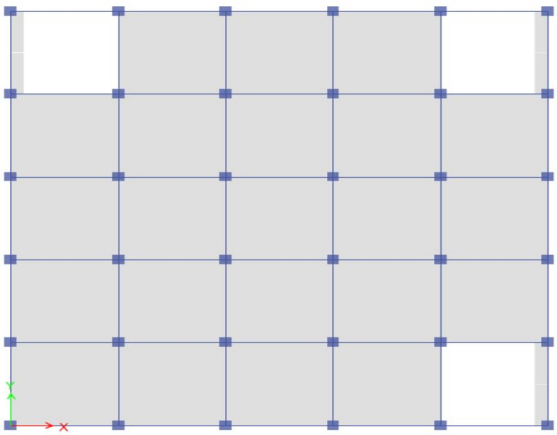

Fig-4: Building with 3-staircase at three corner location

## III.RESULTS AND COMPARISON

*A. Displacement Results*


Fig-5: Building without staircase

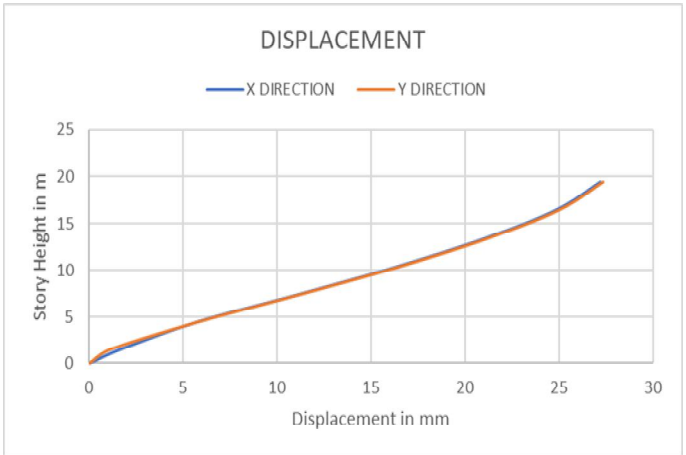


Fig-6: Building with staircase at one corner location

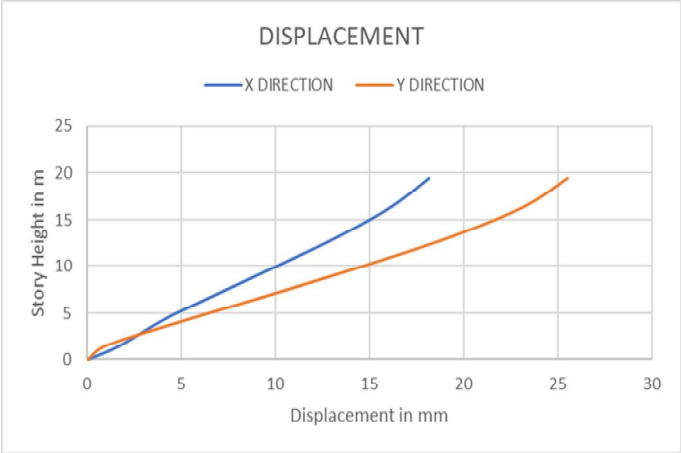


Fig-7: Building with 2-staircase at alternate corner location

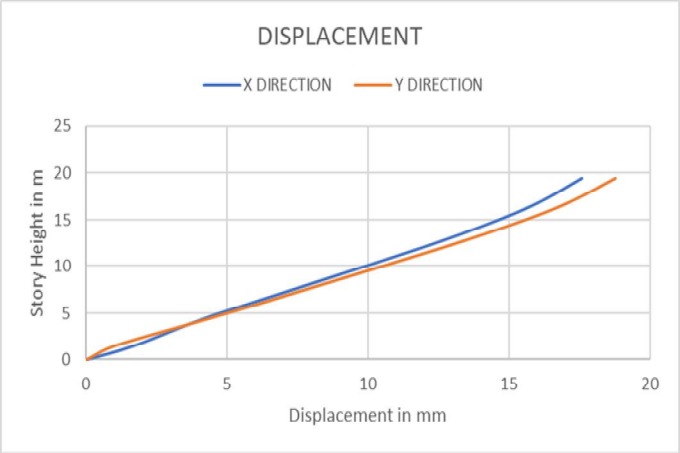


Fig-8: Building with 3-staircase at three corner location

*B. Drift Result*

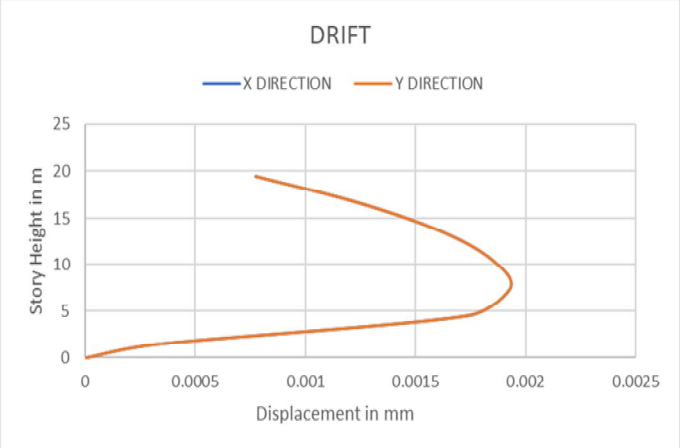


Fig-9: Building without staircase

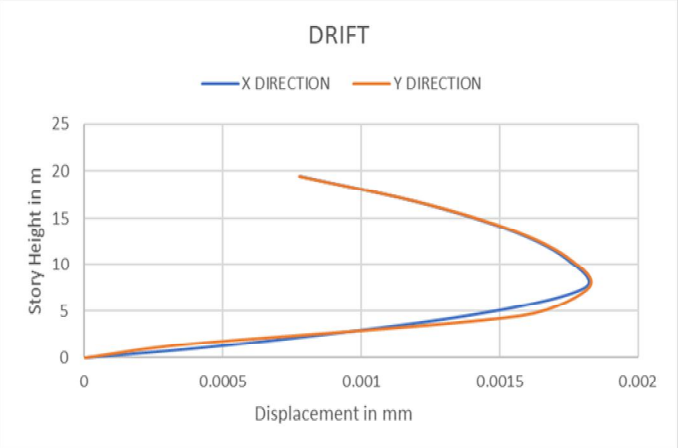


Fig-10: Building with staircase at one corner location

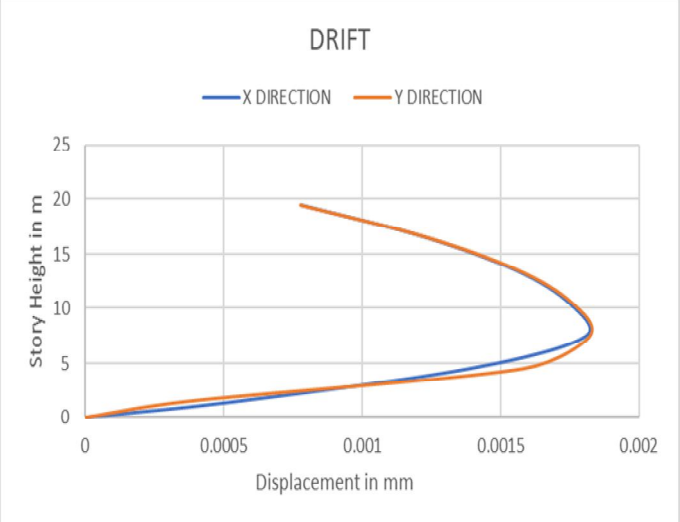


Fig-11: Building with 2-staircase at alternate corner location

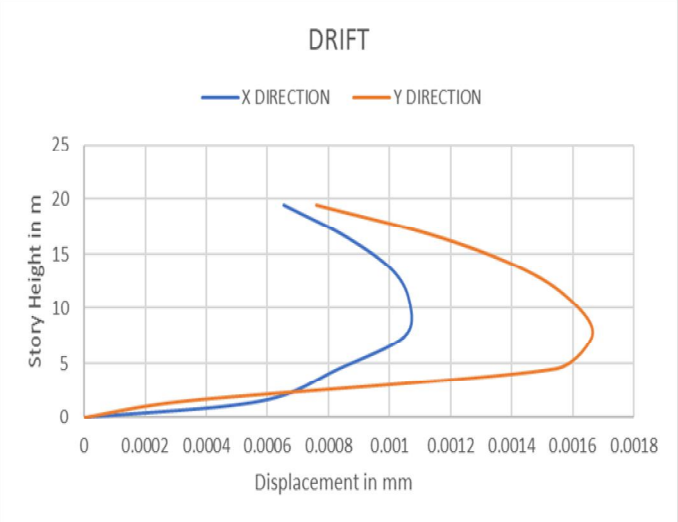


Fig-12: Building with 3-staircase at three corner location

*C. Compartive Diplacement Value in X-Direction & Y-Direction*

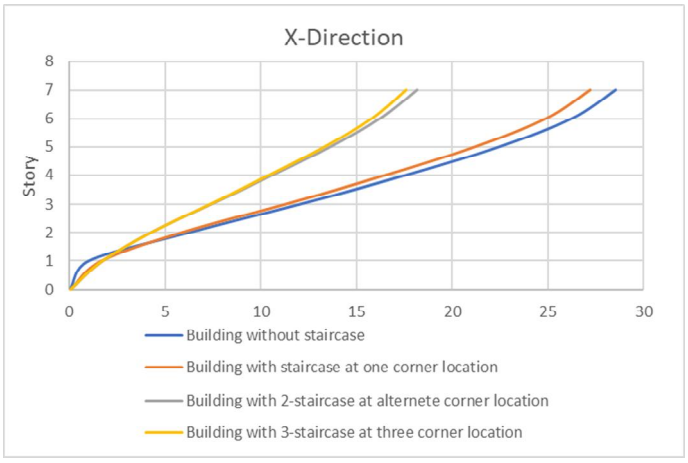


Fig-13: All model Displacement in X-Direction

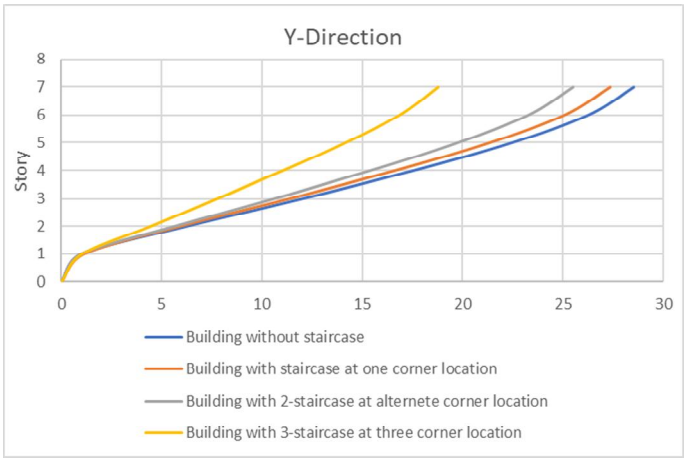


Fig-14: All model Displacement in Y-Direction

*D. Compartive Story Drift Value in X-Direction & Y-Direction*

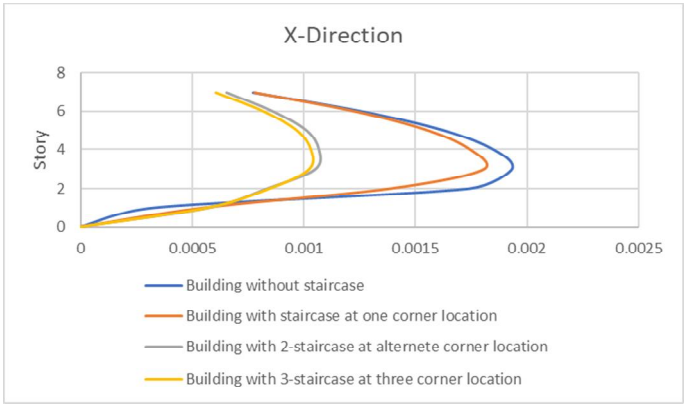


Fig-15: All model Story Drift in X-Direction

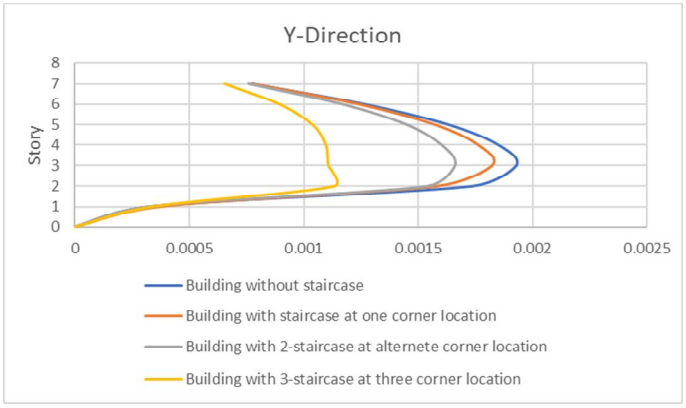


Fig-16: All model Story Drift in Y-Direction

## IV. CONCLUSIONS

From the result made by the study of G+5 Building, following conclusions have been made.

*A.* Having staircase in the building tremendously increase stiffness in the building.
*B.* Story displacement value is decrease with staircase model comparing without staircase model.
*C.* In tall building drift value control by increase shear capacity.
*D.* Staircase cause change in column force, that affected by the position of the staircase.
*E.* After comparing the result of story drift there is decrease in story drift with the increase the number of stairs in a building as compare to without stair.

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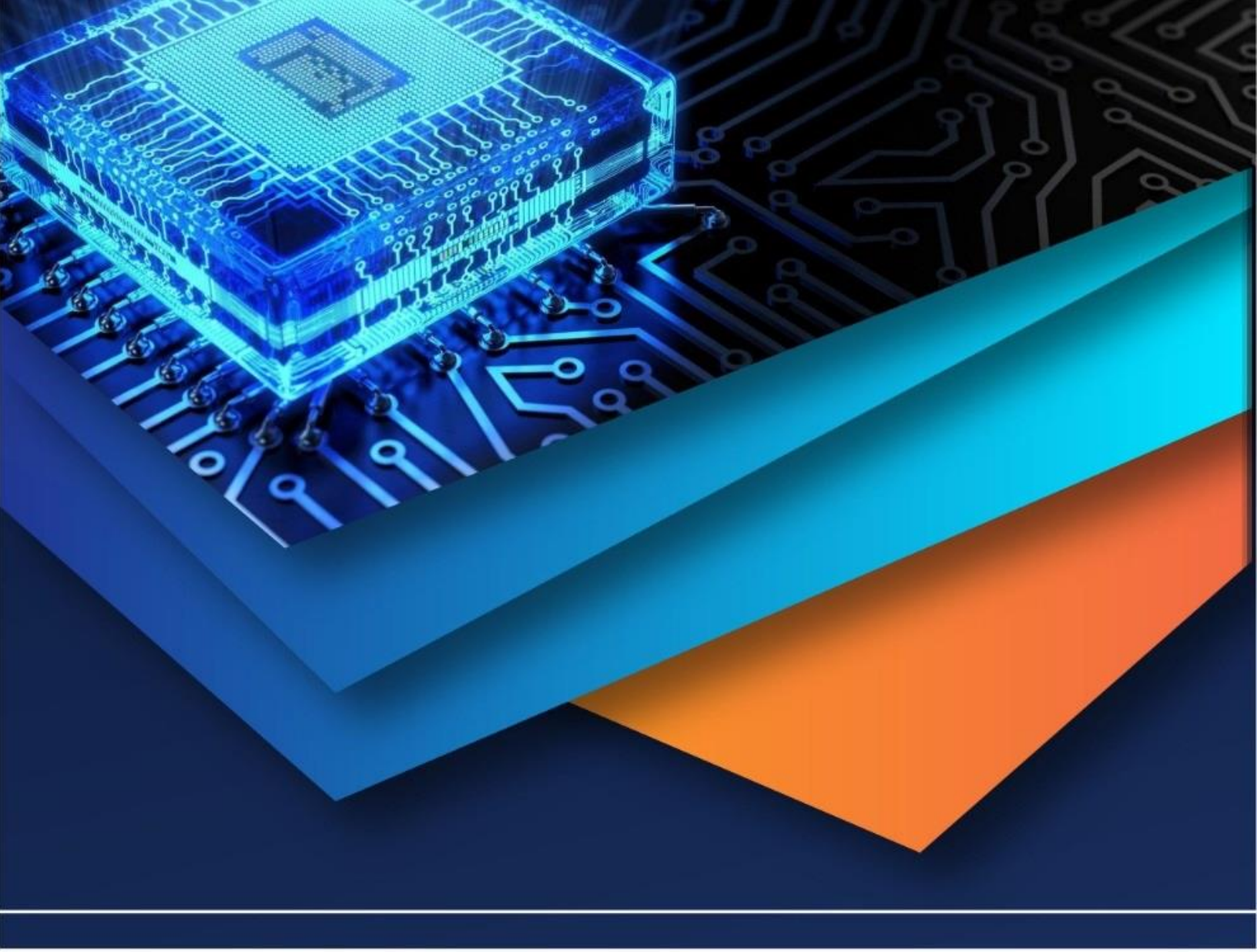

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