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Seismic Performances of Multi-storey Residential Building with and without RCC Shear Wall Structure with ACC Block

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***Abstract:** This study investigates the comparative seismic performance of a multi-storey residential building constructed with Autoclaved Aerated Concrete (ACC) block infill, analyzed both with and without reinforced cement concrete (RCC) shear walls. ACC blocks, known for their lightweight and thermal efficiency, significantly influence the mass and lateral stiffness of a structure, thereby affecting its seismic response. In this research, a typical multi-storey residential building model is developed and evaluated using standard seismic design provisions.*

I. INTRODUCTION

In India, there are so many states which comes in the earthquake zone and we can define earthquake in simple words, “that is the sudden shaking of the Earth's crust, are a recurrent phenomenon in this diverse and dynamic subcontinent. As seismic events continue to influence the topography, society, and infrastructure of the nation.” Seismic performance refers to how well a structure can withstand the forces and motions generated during an earthquake. For multi-storey residential buildings, ensuring good seismic performance is crucial to minimize structural damage and prevent loss of life. The seismic response of a building is influenced by various factors such as building height, weight distribution, stiffness, materials used, and architectural design

II. LITERATURE REVIEW

Lee et al. (2019) This study focuses on the performance of multi-storey buildings with RCC shear walls in regions with high seismic activity. Using both static and dynamic analyses, the research evaluates the behavior of dual frame systems in 20+ storey buildings.
Prakash A.N. (2018) Examine The Behavior for Shear Wall with Different -Different Position of Shear Wall Like Place the Shear Wall at Corner or Placing the Shear Wall at Center and Checked the Behavior.
P. Patel et al. (2018) In this paper, the authors investigate the effects of shear wall thickness on the seismic response of high-rise residential buildings. The study uses finite element analysis to model various building configurations with different shear wall thicknesses. Findings reveal that increasing the thickness of shear walls significantly improves the structure's ability to resist lateral forces, thereby reducing inter- storey drift.
Y. Cheng, et al. (2018) This research paper explores retrofitting options for multi-storey buildings originally designed without shear walls in high seismic risk areas. The authors evaluate the use of bracing systems, including X-bracing, K-bracing, and V-bracing, as potential retrofitting methods to enhance the seismic performance of these structures.
M. Kamal al. (2017) This paper addresses the need for performance-based seismic design (PBSD) in high-rise residential towers with shear wall systems.
M. Takahashi et al. (2017) In this research, the authors study the impact of shear wall placement in asymmetrical multi-storey buildings under seismic loads.

III. RESEARCH OBJECTIVE

The objective of dynamic analysis is to ensure that the multi-story RCC building can withstand the forces generated by dynamic loads, especially seismic forces, without compromising safety.
The main objectives are listed as follow:

1) Structure safety and stability.
2) To Evaluate building performance under seismic loading.
3) To check the Durability of structure.

4) To make economic structure
5) Constructability and ease of maintenance.
6) Compare the result of multistorey building with shear wall and without shear wall.

IV. RESEARCH METHODOLY

There are so many methods for dynamic analysis for high rise building and we are going to do the analysis by response spectrum analysis (DYNAMIC ANALYSIS).

A. *Dynamic Analysis by Response Spectrum Method*

We are creating two model in ETAB SOFTWARE ULTIMATE 21.1.0.

- In which 1st is without shear wall building structure.
- In which 2nd is with shear wall building structure.

B. *Response Spectrum Analysis (RSA)*

Response spectrum analysis is a powerful tool in earthquake engineering for assessing the dynamic response of structures subjected to seismic ground motion. It involves the application of a response spectrum, which is a graphical representation of a structure's response to a range of ground motion frequencies

In the realm of structural engineering, where the forces of nature can shape the destiny of built environments, the quest for understanding and predicting a structure's behavior under seismic forces has given rise to sophisticated analytical methods. Among these, Response Spectrum Analysis (RSA) stands out as a pivotal tool, providing engineers with a comprehensive means to evaluate and enhance the seismic resilience of structures. This essay delves into the intricacies of Response Spectrum Analysis, examining its principles, applications, and significance in the context of earthquake engineering body.

V. DYNAMIC ANALYSIS OF MULTI-STOREY BUILDING

Geometry of Multi-storey Residential Building

The dimension of (G+5) multistory reinforced building dimension is given below.

1) Location of building-ASSAM
2) Types of building-RCC FRAMED STRUCTURE
3) Foundation to ground floor height - 1 m
4) Ground floor to first floor height - 3.75m
5) First floor to terrace floor height- 3.3 m
6) Terrace floor to MUMTY floor height-2.5 m
7) Water tank room to machine room height -2 m
8) MUMTY floor to water tank room height-1 m
9) Number of stories-5
10) The plan dimension of structure is 42 m by 23 m.
11) Bearing capacity of soil =200 KN/m2
12) External wall thickness = 0.2 m
13) Internal wall thickness = 0.125 m
14) Density of wall=20

Seismic Parameter of the Building

NAME	VALUE
SEISMIC ZONE	V
ZONE FACTOR	0.36
RESPONSE REDUCTION FACTOR(R)	5
SOIL TYPE	MEDIUM SOIL(II)
IMPORTANCE FACTOR(I)	1

VI. RESULT AND DISCUSSION

There are so many parameter, which can be compared

1) Base Shear
- In X Direction
- In Y Direction

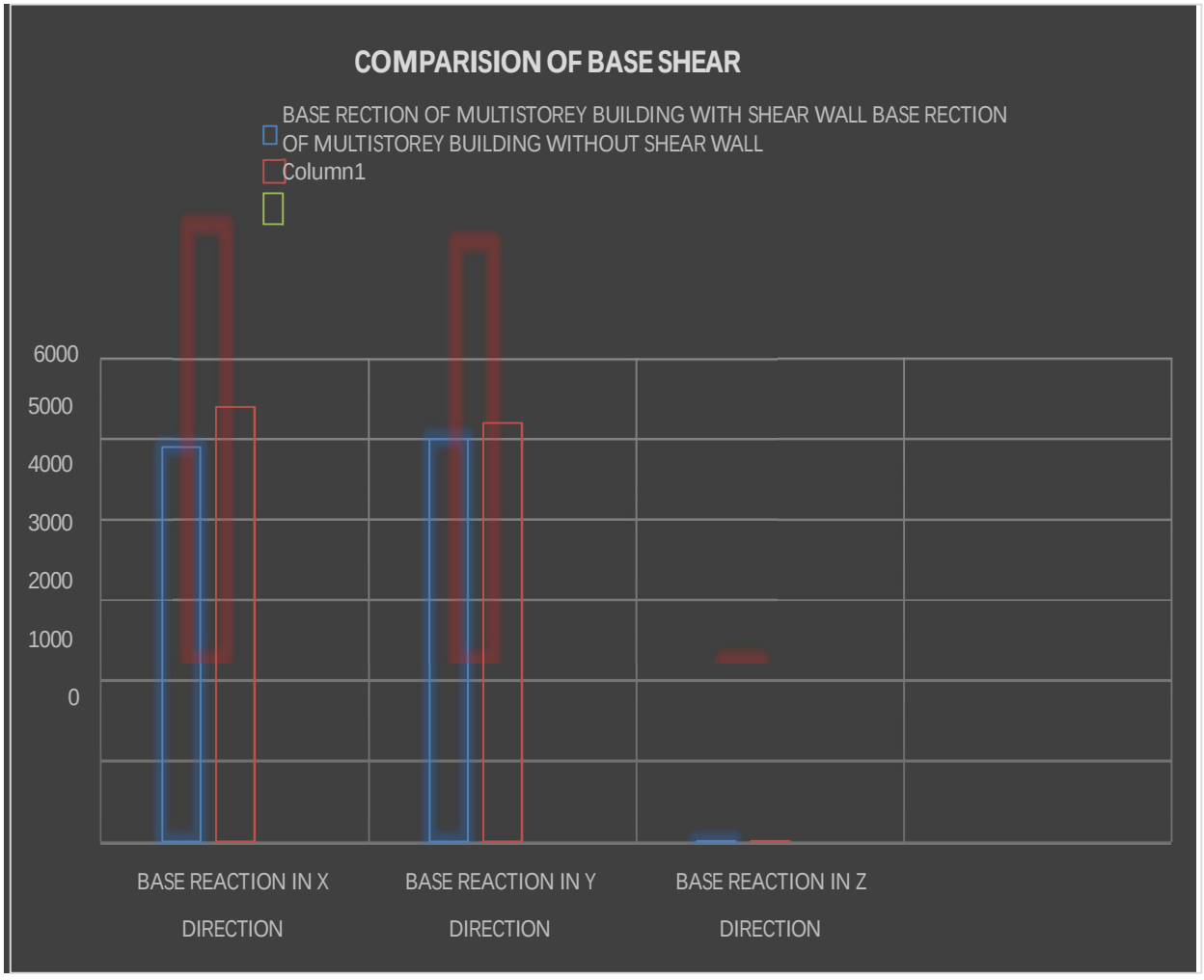
2) Max Story Drift
- In X Direction
- In Y Direction

3) Max Story Displacement
- In X Direction
- In Y Direction

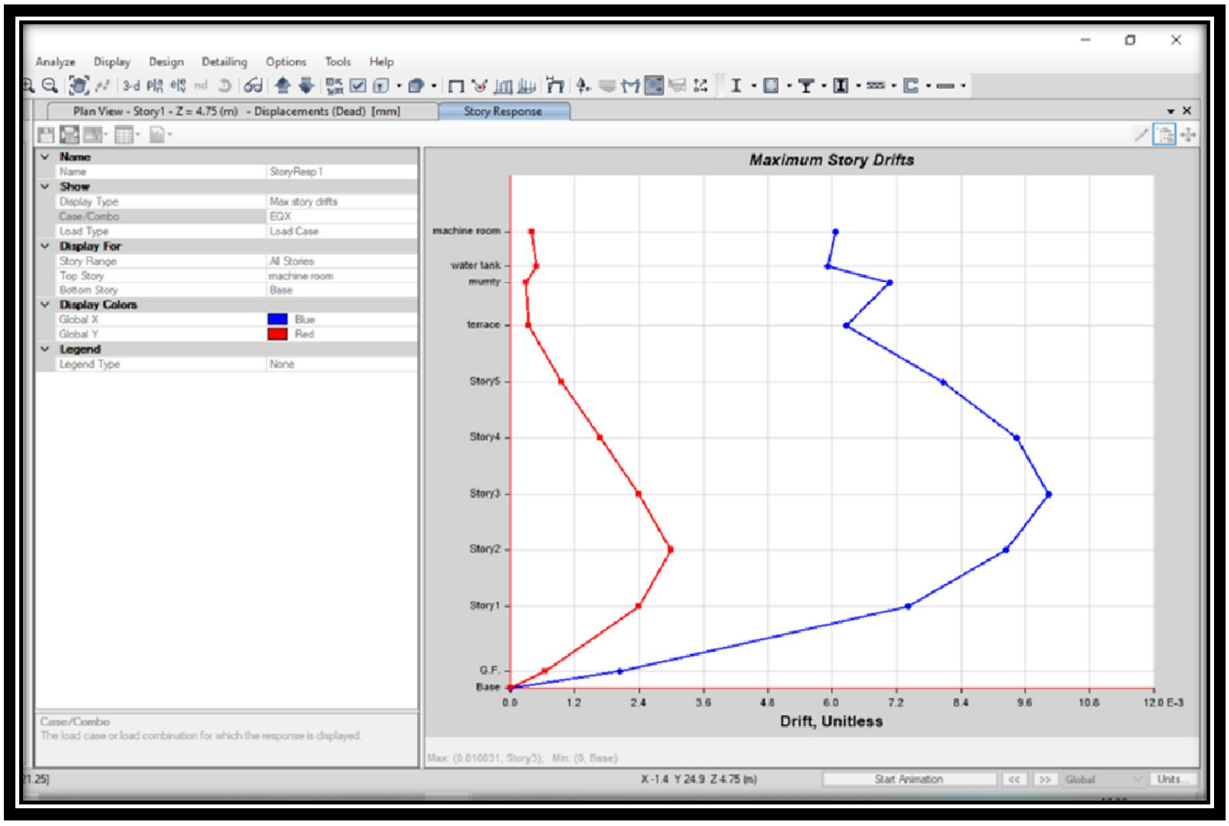
4) Torsion /Time Period

5) Story Stiffness

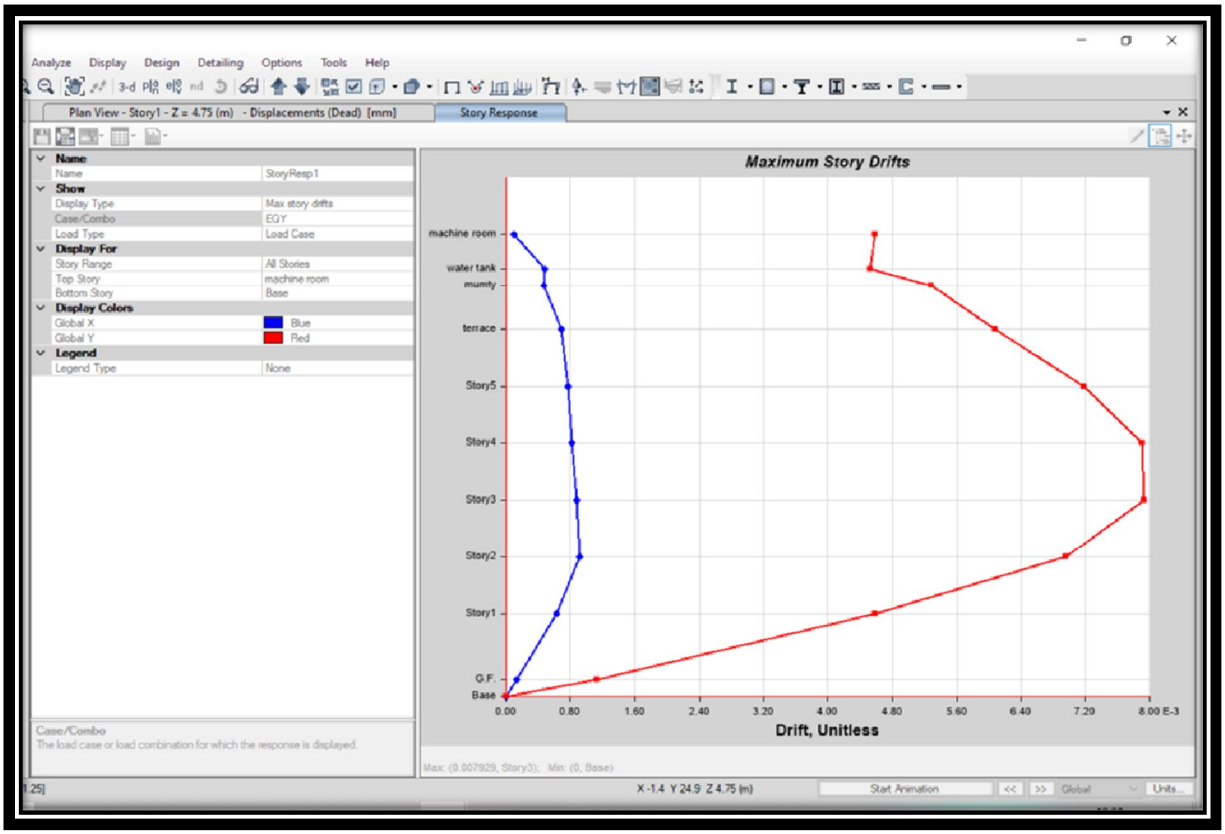
Campare The Base Shear Reaction Of Multistorey Buildin With Shear Wall And Without Shear Wallcampare The Maximum Story Drift Of Multistoreybuildin With Shear Wall And Without Shear Wall

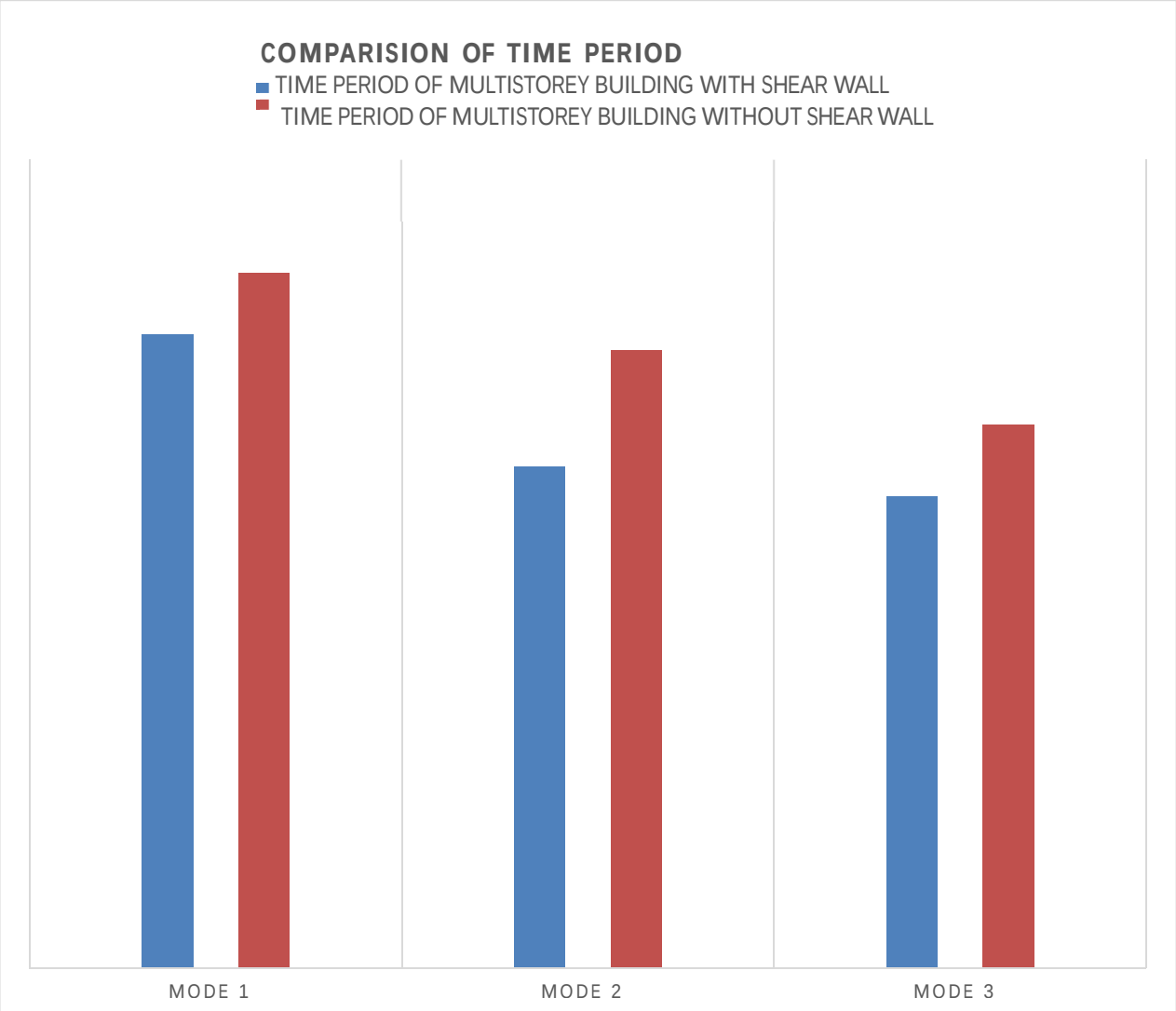


Max Storey Drift For X Direction In Shear Wall



Max Storey Drift For Y Direction In Shear Wall





VII. CONCLUSION

From this study we have so many conclusions which is following:

1) The change in maximum story displacement in x direction is 25-50 mm in compare of with shear wall or without shear wall.
2) The change in maximum story displacement in y direction is 50-60 mm in compare of with shear wall or without shear wall.
3) The change in maximum story drift in x direction is 0.01-0.013 in compare of with shear wall or without shear wall.
4) The change in maximum story drift in y direction is 0.008-0.0113 in compare of with shear wall or without shear wall.
5) The torsion present in first mode and second mode in without shear wall model while torsion is not present in with shear wall model.
6) The change in maximum story stiffness in x direction is 100000-110000 KN/m in compare of with shear wall or without shear wall.
7) The change in maximum story stiffness in y direction is 200000-250000 KN/m in compare of with shear wall or without shear wall.
8) The base shear of multistorey building with shear wall in x-direction is 4900 KN/m while. The base shear of multistorey building without shear wall in x-direction is 5400 KN.
9) The base shear of multistorey building with shear wall in y-direction is 5125 KN/m while. The base shear of multistorey building without shear wall in x-direction is 5190 KN.

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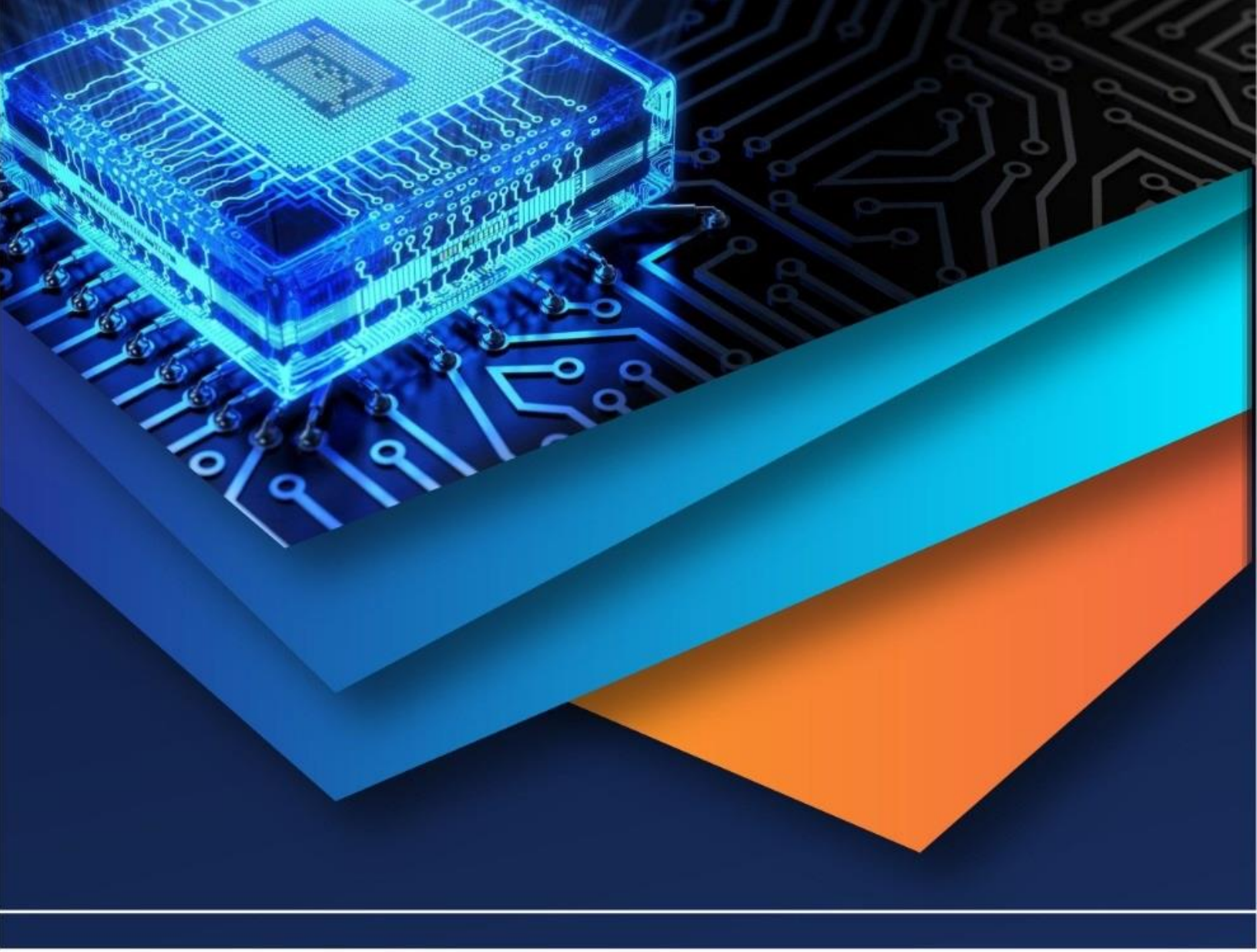

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