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Analysis and Design of Cable Stayed Bridge using STAAD-PRO

Akshay Sagale[1], Sandip Dongre[2]
[1]P.G. Student, [2]Assistant Professor, Department of Civil Engineering, G.H. Raisoni University,Amravati, Maharashtra, India

Abstract: The remaining bridge is a very statically undefined structure, which takes place as a continuous beam that is supported elastic in the points of cable attachments. Except for the cases of very simple cable-stayed bridge, the computer is necessary to solve this type of structure. Computer programs are needed to generate impact schemes for the cable forces, the rigidity of the beam, bending moments and scissors, as well as towers and pier reactions. Programs are also needed to quickly solve a variety of parametric efforts and loads, which should be taken into account when achieving a fairly effective design. Probably the most important problems are the definition of the optimum section of the rigidity section, as well as the configuration and cable size. The present work deals with the analysis and design of cable stayed bridge. This is carried out in STAAD-PRO software, the results obtained are in terms of displacement, reactions, forces and stresses.
Keywords: Cable stayed Bridge, IRC loading, displacement and reactions

I. INTRODUCTION

Overcoming the gap remains a symbol of triumph of humanity over nature. The longer and unattainable the abyss, the more it is ADTA for the structure of the bridge. The cable remained bridges, a synonym of flown over a large open space, so has always been regarded as a tribute to human achievement. The idea of using cables to maintain the bridge spans is not new, and a number of examples of this type of construction were recorded long ago. Sloping stay were first introduced in England and widely used there in the early 19^{th} century. Cable-remaining bridges have become effective alternatives in case of large bridges.

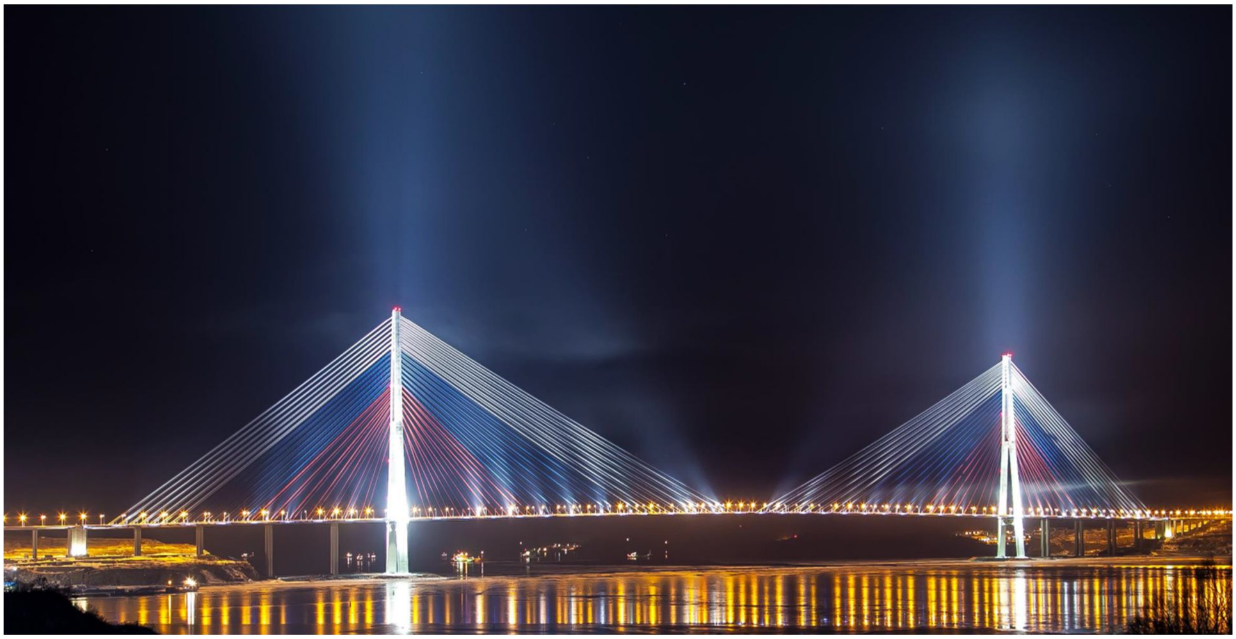

Figure No.1: Russky Bridge, Vladivostok, Russia

Longitudinal cable behavior-The remaining bridge can be understood as the beam on discrete elastic poles and bending the beam will prevail. A number of methods can be used to analyze cable-the remaining bridges. There are many precise methods, such as the cross-matrix approach, as adopted by Tang, a mixed force displacement method, as is customary to Smith, and recently used finite element methods used to analyse the structure. These methods care about both material as well as geometric nonlinearity, because the cable-remained bridges exhibition of both types of linear behavior.

II. REVIEW OF LITERATURE

Kao and Kou (2010) analyzed the symmetric, fan-shaped cable remained the bridge under sudden loss of cable, as this is the most critical phenomenon in the analysis of the cable left the bridge.

Wolf and Starosek (2008) studied the behavior of the 3D cable-the remaining model of the bridge and found out that the initial failure (loss) of the three cables around the pylon could provoke a zipper type of collapse associated with large vertical deformation within the framework of the bridge deck.

Jenkins and Hersten (2001) reports to the FTA report that about 58% of the terrorist attacks targeted the transport sector, including bridge structures. Mamed (2007) analyzed the typical bridges of the highway under explosive load.

(Juan et al., 2011) studied significant damage and the collapse of several bridges that occurred as a result of major earthquake events in the past. Therefore, he recommends different guidelines for responding to seismic actions seen in the design of bridges. For example, the Xiaoyudong bridge in China was damaged during the May 12, 2008 venture earthquake with a magnitude of 8.0.

(Kawashima et al., 2011, Goshikuma, 2011) is studying a strong earthquake in Japan in Fukushima, which has created significant losses in several bridges, caused by strong movement of the Earth, as well as tsunami pouring and thinners of dynamic cable reaction the remaining bridges are more critical due to the effects of earthquakes and wind loads compared to other types of bridges. However, with increasing the length of the span and the increase in slenderness on the rigidity of the beam much attention is paid not only to the dynamic reaction of bridges under the earthquake and the load on the wind.

III. METHODOLOGY

The modeling of the cable stayed bridge is carried out in STAAD-PRO as follows.

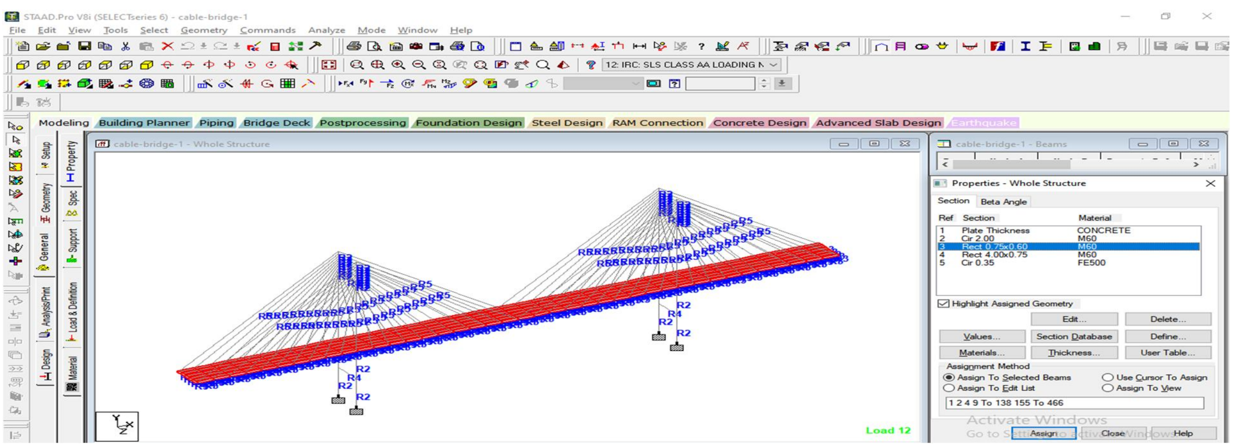

Figure No.2: Sectional properties of Cable stayed bridge

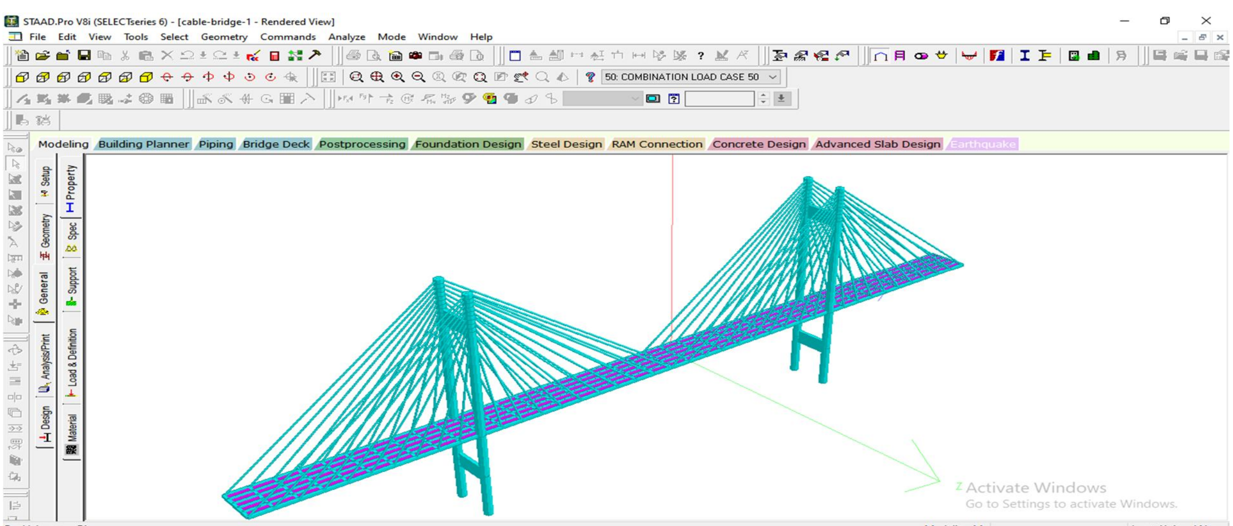

Figure 3: Modeling of cable stayed bridge

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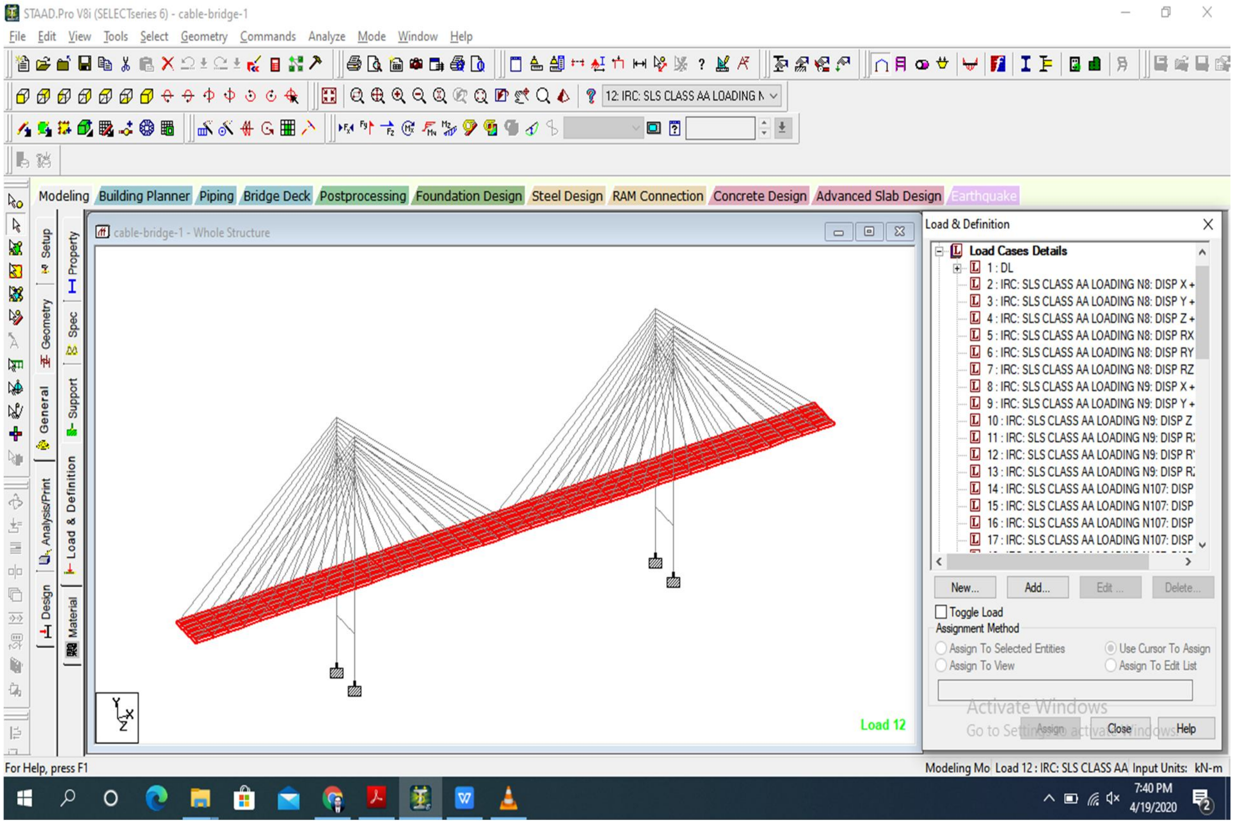

Figure 4: IRC loading applied on Bridge

IV. RESULTS

The results of cable stayed bridge is obtained in the STAAD-PRO software and they are presented as follows.

Table 1: Displacement of Cable Stayed Bridge

			Horizontal	Vertical	Horizontal	Resultant
	Node	L/C	X mm	Y mm	Z mm	mm
Max X	7	1 DL	34.886	-22.327	-0.276	41.42
Min X	6	1 DL	-34.886	-22.327	-0.276	41.42
Max Y	66	1 DL	0	14.862	0.028	14.862
Min Y	14	1 DL	6.592	-96.046	0.031	96.272
Max Z	104	1 DL	-34.886	-22.327	0.276	41.42
Min Z	6	1 DL	-34.886	-22.327	-0.276	41.42
Max rX	67	1 DL	0	14.862	-0.028	14.862
Min rX	66	1 DL	0	14.862	0.028	14.862
Max rY	27	1 DL	-6.891	-80.368	-0.117	80.663
Min rY	26	1 DL	6.891	-80.368	-0.117	80.663
Max rZ	116	1 DL	3.796	-29.042	0.034	29.289
Min rZ	151	1 DL	-3.796	-29.042	0.034	29.289
Max Rst	14	1 DL	6.592	-96.046	0.031	96.272

Table 2: Reaction of Cable Stayed Bridge

		Horizontal	Vertical	Horizontal	Moment		
	Node	Fx kN	Fy kN	Fz kN	Mx kNm	My kNm	Mz kNm
Max Fx	9	91.215	30086.525	-2.948	-15.263	-1.193	-935.263
Min Fx	8	-91.215	30086.525	-2.948	-15.263	1.193	935.263
Max Fy	8	-91.215	30086.525	-2.948	-15.263	1.193	935.263
Min Fy	8	0	0	0	0	0	0
Max Fz	106	-91.215	30086.525	2.948	15.263	-1.193	935.263
Min Fz	8	-91.215	30086.525	-2.948	-15.263	1.193	935.263
Max Mx	106	-91.215	30086.525	2.948	15.263	-1.193	935.263
Min Mx	8	-91.215	30086.525	-2.948	-15.263	1.193	935.263
Max My	8	-91.215	30086.525	-2.948	-15.263	1.193	935.263
Min My	9	91.215	30086.525	-2.948	-15.263	-1.193	-935.263
Max Mz	8	-91.215	30086.525	-2.948	-15.263	1.193	935.263
Min Mz	9	91.215	30086.525	-2.948	-15.263	-1.193	-935.263

Table 3: Beam Forces of Cable Stayed Bridge

	Beam	Fx kN	Fy kN	Fz kN	Mx kNm	My kNm	Mz kNm
Max Fx	143	30086.525	91.215	2.948	1.193	15.263	-935.263
Min Fx	500	-1564.983	249.443	0	0	0	0
Max Fy	52	-67.895	852.08	-2.037	50.168	1.91	1482.286
Min Fy	339	-67.895	-852.081	2.037	-50.168	1.91	1482.287
Max Fz	7	26780.604	91.215	199.377	1.817	-1670.462	1345.11
Min Fz	141	26780.602	91.215	-199.377	-1.817	1670.462	1345.11
Max Mx	47	1009.006	170.344	0.232	132.122	-1.337	181.575
Min Mx	46	1009.006	170.344	-0.232	-132.122	1.337	181.575
Max My	141	26780.602	91.215	-199.377	-1.817	1670.462	1345.11
Min My	7	26780.604	91.215	199.377	1.817	-1670.462	1345.11
Max Mz	339	-67.895	-852.081	2.037	-50.168	1.91	1482.287
Min Mz	8	26780.604	-91.215	199.377	-1.817	-1670.462	-1345.11

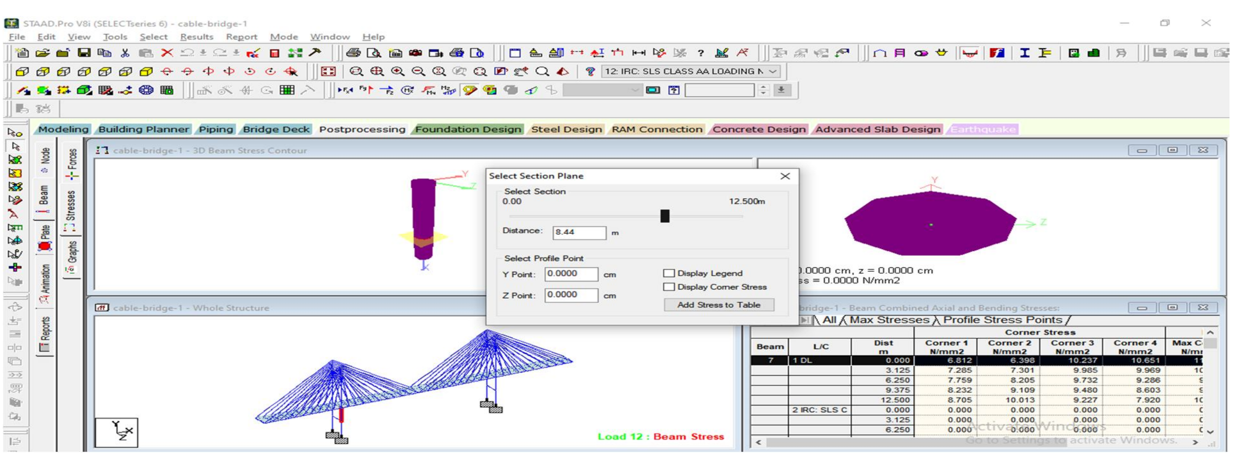

Figure 5: Stress Graph of element of Bridge

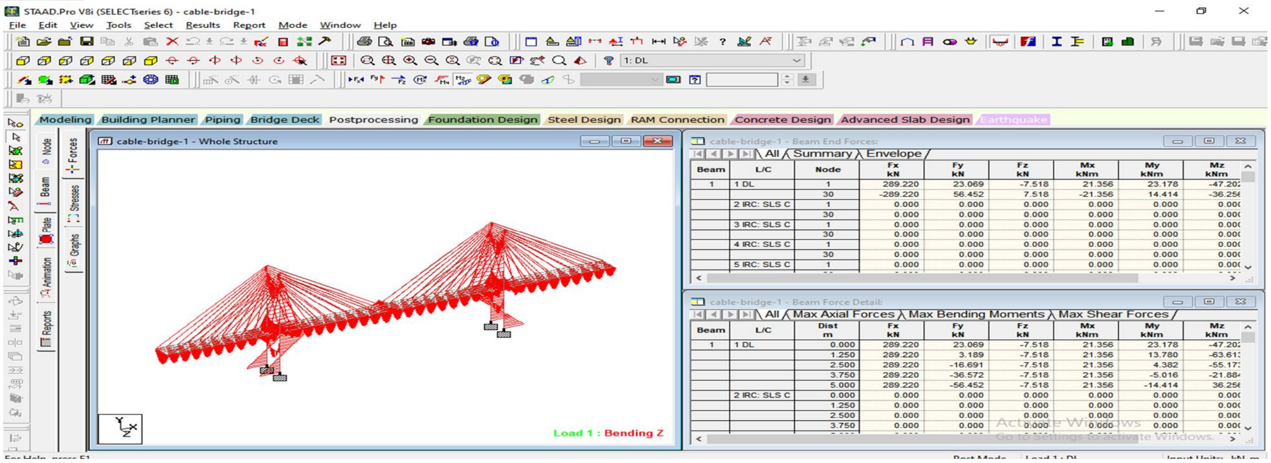

Figure 6: Bending Moment Diagram of Bridge

V. CONCLUSION

From the above study following conclusions are obtained :

A. The cable stayed bridge analysis is possible in STAAD-PRO.
B. The different element of Bridge is to be given the properties with due care.
C. The forces and stresses on the bridges are obtained.
D. The IRC loading is applied on the bridge and the displacement is within the permissible limits

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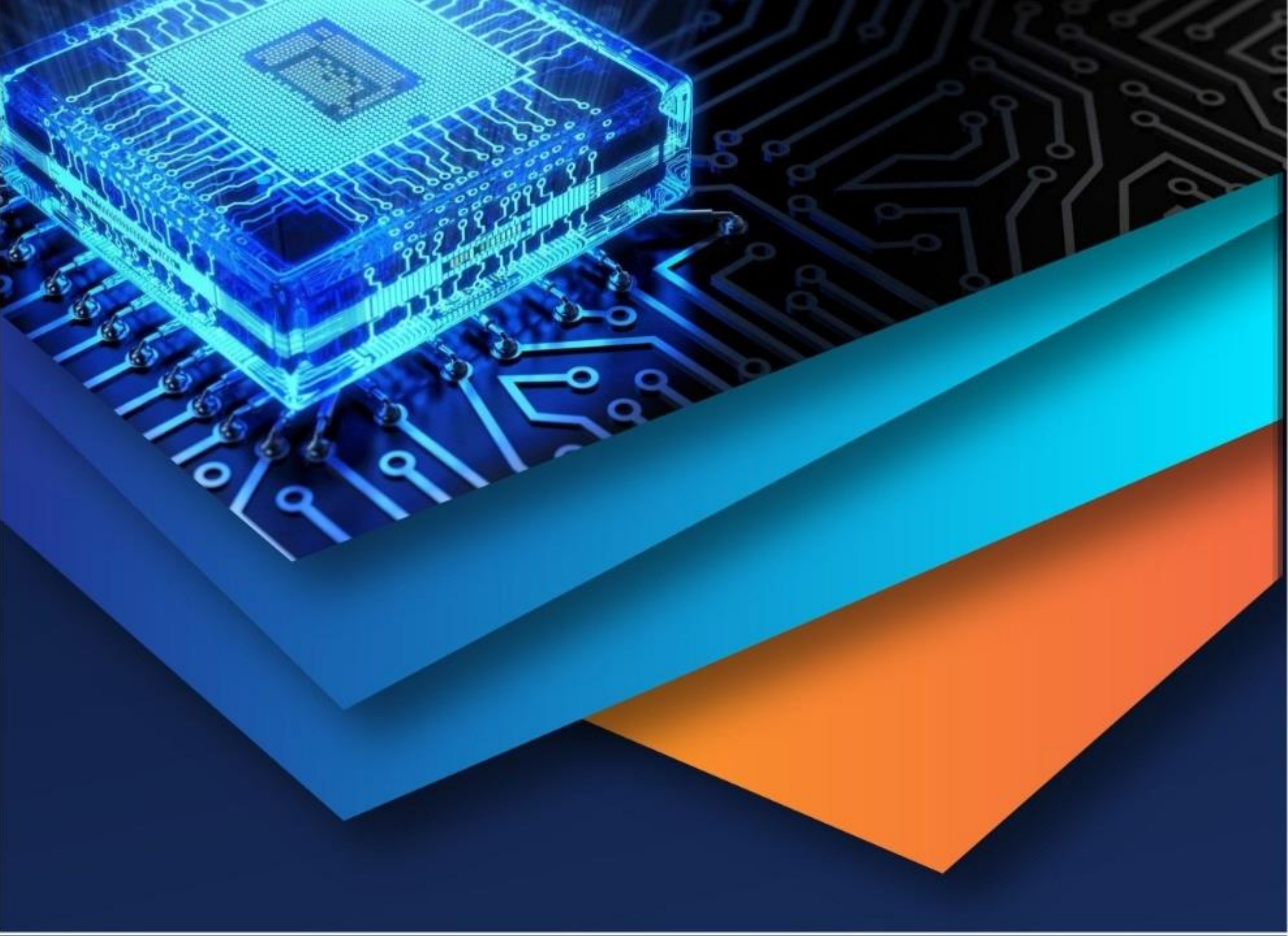

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