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MATLAB Simulation Model of Hybrid Wind-Solar Energy System using MPPT Algorithm using a Converter Topology

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Abstract: ***The proposed framework presents control techniques of a matrix associated half and half age framework with adaptable power exchange. This half and half framework permits most extreme use of unreservedly accessible sustainable power sources like breeze and photovoltaic energies. For this, a versatile MPPT calculation alongside standard bothers and watches strategy will be utilized for the framework. Likewise, this arrangement enables the two sources to supply the heap independently or at the same time contingent upon the accessibility of the vitality sources. The turbine rotor speed is the fundamental determinant of mechanical yield from wind vitality and Solar cell working voltage on account of yield control from sun powered vitality. Lasting Magnet Synchronous Generator is combined with wind turbine for accomplishing wind vitality change framework.***
Keywords: Fuel cell, Photovoltaic, Wind energy conversion, Wind Turbines, Z- source converter

I. INTRODUCTION

Late advancements and patterns in the electric power utilization demonstrate an expanding utilization of sustainable power source. For all intents and purposes all locales of the world have inexhaustible assets of some sort. By these perspective examinations on sustainable power sources concentrates increasingly more consideration. Sun based vitality and wind vitality are the two sustainable power sources most normal being used. Wind vitality has turned into the most affordable sustainable power source innovation in presence and has crested the enthusiasm of researchers and instructors over the world [1]. Photovoltaic cells convert the vitality from daylight into DC power. PVs offer included focal points over other sustainable power sources in that they emit no commotion and require for all intents and purposes no upkeep [2]. Hybridizing sun oriented and wind control sources give a reasonable type of intensity age.

Numerous investigations have been done on the utilization of sustainable power hotspots for power age and numerous papers were displayed before. The breeze and sun based vitality frameworks are very problematic because of their capricious nature. In [3], a PV board was consolidated with a diesel electric power framework to dissect the decrease in the fuel devoured. It was seen that the joining of an extra inexhaustible source can additionally decrease the fuel utilization. A few half breed wind/PV control frameworks with Maximum Power Point Tracking (MPPT) control have been proposed before [4]. They utilized a different DC/DC buck and buck-support converter associated in combination in the rectifier stage to play out the MPPT control for every one of the sustainable power source control sources. These frameworks have an issue that, because of the natural components affecting the breeze turbine generator, high recurrence current music are infused into it. Buck and buck-support converters don't have the ability to take out these music. So the framework requires latent info channels to expel it, making the framework progressively massive and costly [5]. In this paper, another converter topology for hybridizing the breeze and sunlight based vitality sources has been proposed. In this topology, both breeze and sun based vitality sources are fused together utilizing a blend of Cuk and SEPIC converters, so that on the off chance that one of them is inaccessible, at that point the other source can adjust for it. The Cuk-SEPIC intertwined converters have the capacity to dispose of the HF current sounds in the breeze generator. This takes out the need of uninvolved information channels in the framework. These converters can bolster venture up and venture down activities for each sustainable power sources. They can likewise bolster individual and synchronous activities. Sun based vitality source is the contribution to the Cuk converter and wind vitality source is the contribution to the SEPIC converter. The normal yield voltage delivered by the framework will be the whole of the contributions of these two frameworks. Every one of these points of interest of the proposed half breed framework make it exceedingly proficient and solid.

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II. MPPT ALGORITHM

On account of the lesser productivity of photovoltaic cluster a large portion of the vitality, affecting over exhibit gets squandered. The calculation known as greatest power point following might be useful to upgrade the execution of sun powered board. The MPPT calculation takes a shot at chief of Thevenin, concurring which the power yield of a circuit is greatest when impedance of circuit matches with the heap of impedance. So now we need to coordinate the impedance as opposed to following most extreme power point.

There are diverse procedures used to follow the greatest power point. Maybe a couple of the most well-known strategies are:

1) Perturb and observe (hill climbing method)
2) Incremental Conductance method
3) Fractional short circuit current
4) Fractional open circuit voltage

A. Perturb and observe

The P&O calculation and "slope climbing", the two names allude to a similar calculation relying upon how it is executed. The essential distinction between these two is that Hill-climbing includes a deviation of the obligation cycle of the power converter and in P&O nervousness on the working voltage of the DC connect between the PV exhibit and the power converter happens [3]. The deviation of obligation cycle of the power converter is the adjustments of the voltage of DC connect between the PV exhibit and the power converter alludes as Hill-climbing, so the two names allude to a similar method. What ought to be the following irritation is chosen by thinking about the indication of the last bother and the indication of the last augmentation in the power. The bother will stay a similar way in the event that control is augmented, and on the off chance that control is diminished, at that point next annoyance will be the other way. The procedure will be rehashed until the purpose of most extreme power will be come to. At that point the working point sways around the MPP.

B. Incremental conductance

The slope of the curve between power and voltage of PV module is the deciding factor in incremental conductance algorithm, if it is zero it shows point of MPP positive (negative) on the left of it and negative (positive) on the right.

1) $\Delta V/\Delta P = 0$ at the MPP
2) $\Delta V/\Delta P > 0$ on the left
3) $\Delta V/\Delta P < 0$ on the right

The change of MPP voltage is identified by comparing the change of the power to increment of the voltage of current curve.

C. Fractional short circuit current

Fractional short circuit current method states that the ratio between array voltages at maximum power V_{MPP} to its open circuit voltage V_{OC} is nearly constant. $V_{MPP} \approx k_1 V_{OC}$

The constant K_1 is having value between 0.71 to 0.78. Now the value of V_{MPP} can be calculate by periodically measuring V_{OC}. This method is simple and cheap to implement but its efficiency is relatively low due to the utilization of inaccurate values of the constant k1 in the computation of V_{MMP} .

D. Photovoltaic cell

To change over the light vitality provided by sun the semiconductor arrangement is the photovoltaic cell it changes over light vitality to electrical vitality by photovoltaic impact. The vitality photons are accessible with light, if there vitality is more prominent than the vitality hole of nuclear hardware, than the external most electrons of iotas are get discharged on account of the effect of these photon. These electrons get stream uninhibitedly and cause current. The development of photovoltaic cell is comparable as the development of p-n intersection diode. A photovoltaic cell is made out of two unique layers of silicon one is P-type layer where negative particles are there with one less valence electron and other is N-type layer with positive particles with one additional valence electron. At the intersection of these two layers additional electrons of N-layers get diffused with less electron space of P – layer and leave area with positive and negative particles as it were. This space is known as dispersion layer, the dissemination layer go about as a defensive layer and stops the exchange of electron over the intersection when balance is come to. At the point when sun based vitality is forced the vitality of electrons accessible will increment and again exchange of electron get begin. This will cause stream of flow and convert sunlight based vitality into electric vitality.

MATLAB Modelling

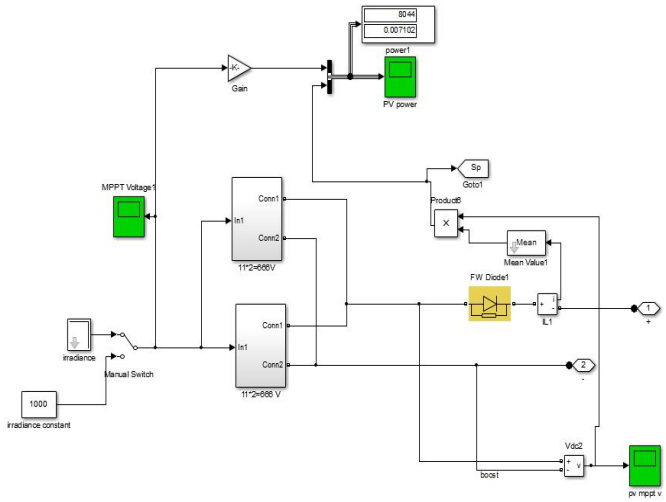


Figure 1: MATLAB Model for PV System

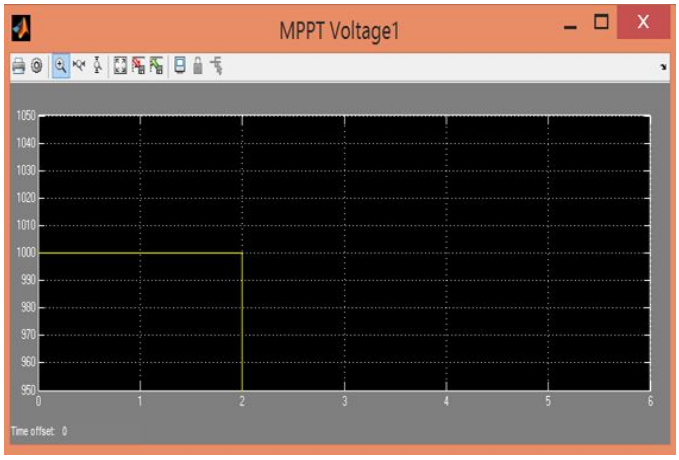


Figure 2: Output Voltage of Maximum Power Point Tracking

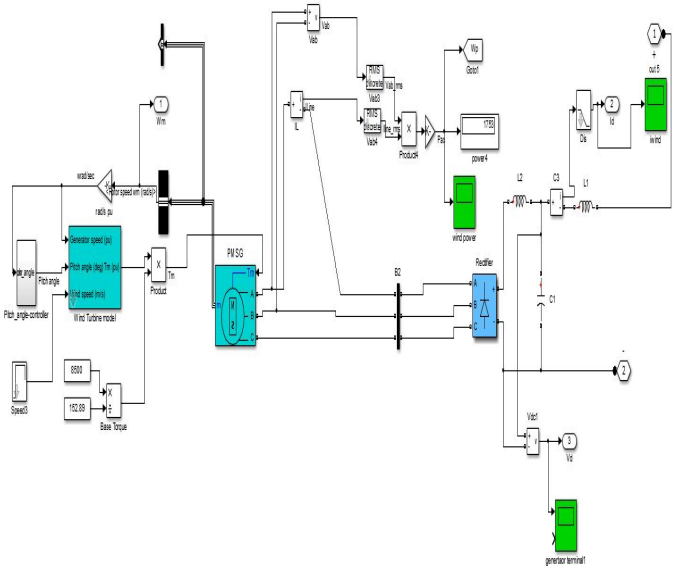


Figure 3: MATLAB Model for Wind System

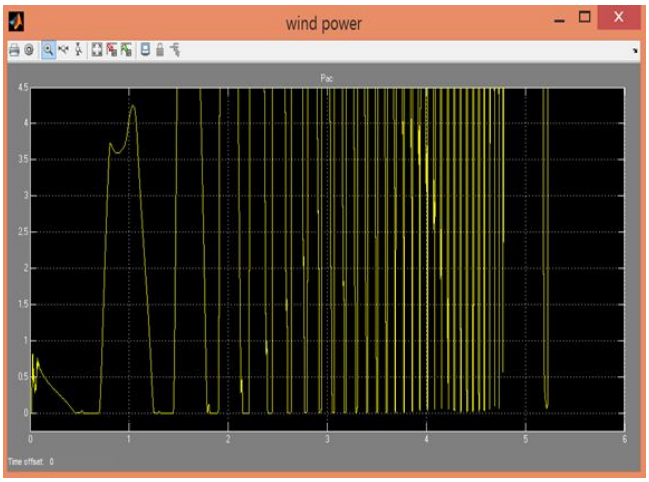


Figure 4: Output Voltage of Wind Power

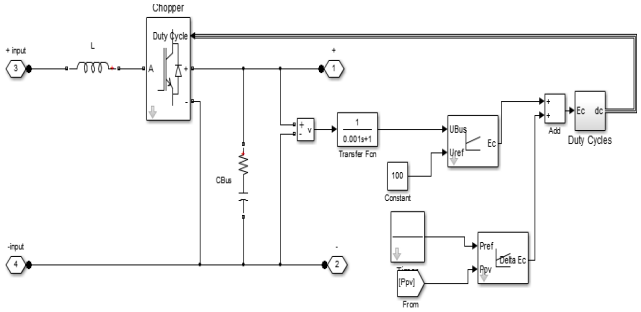


Figure 5: MATLAB Model for DC-DC Converter

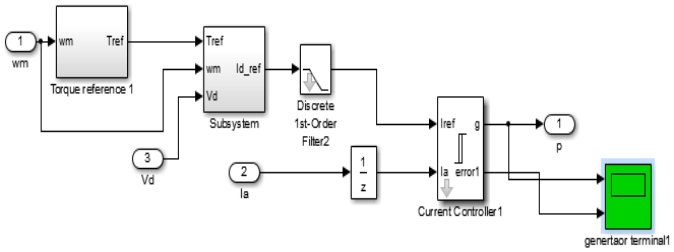


Figure 6: MATLAB Model for wind MPPT

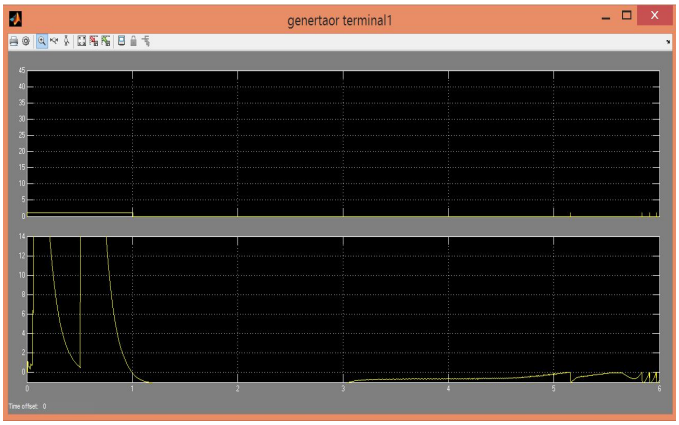


Figure 7: Generator Voltage of wind MPPT

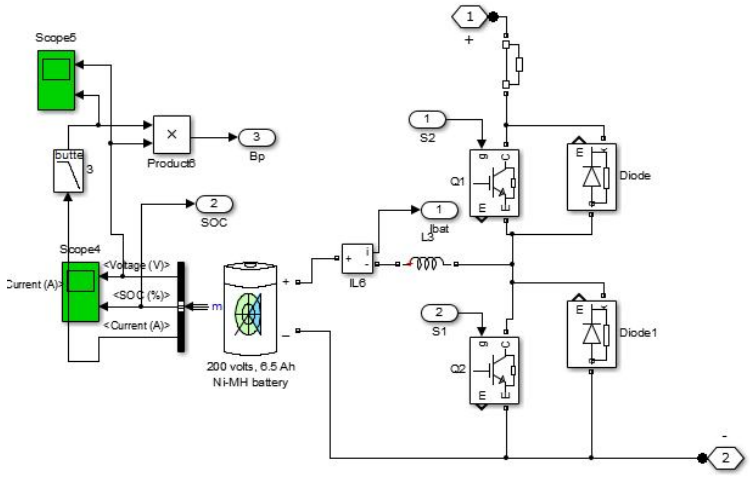


Figure 8: MATLAB Model for Battery and DC-DC Converter

III. SIMULATION MODEL

The proposed framework presents control procedures of a matrix associated half and half age framework with flexible power exchange. This half and half framework permits most extreme usage of openly accessible sustainable power sources like breeze and photovoltaic energies. For this, a versatile MPPT calculation alongside standard bothers and watches technique will be utilized for the framework. Likewise, this arrangement enables the two sources to supply the heap independently or all the while relying upon the accessibility of the vitality sources. The turbine rotor speed is the principle determinant of mechanical yield from wind vitality and Solar cell working voltage on account of yield control from sun based vitality. Changeless Magnet Synchronous Generator is combined with wind turbine for accomplishing wind vitality transformation framework.

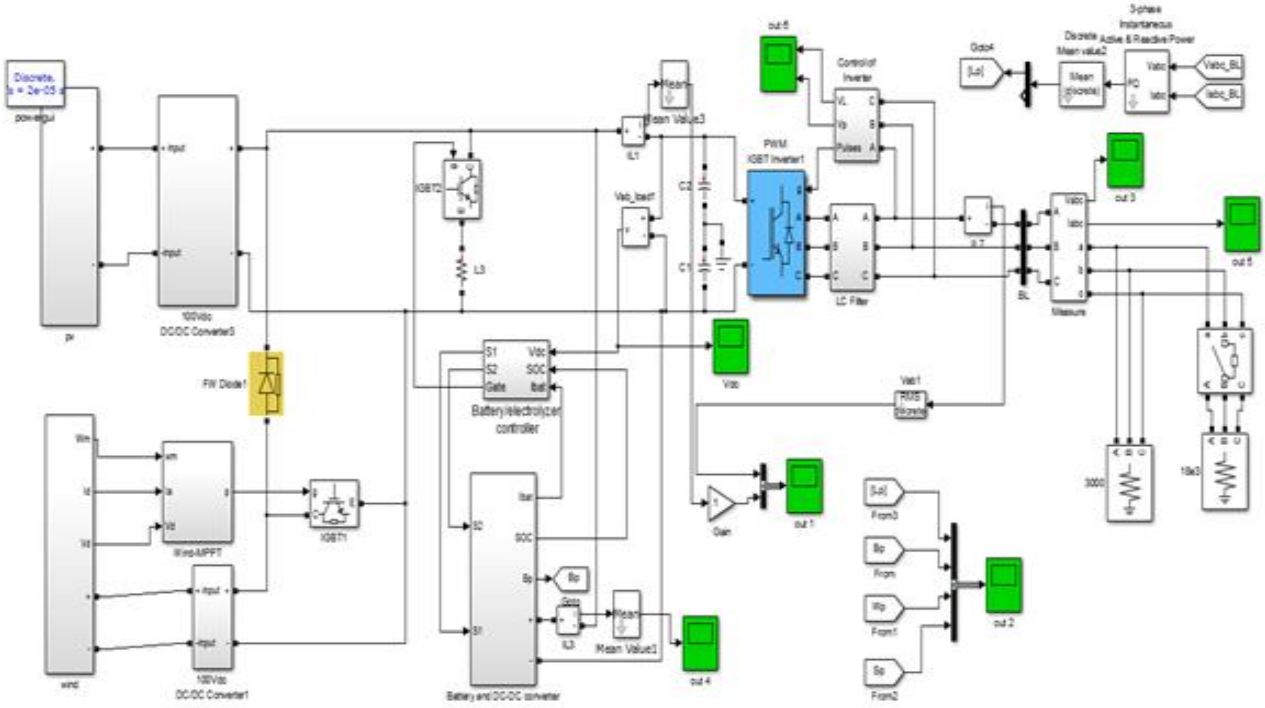
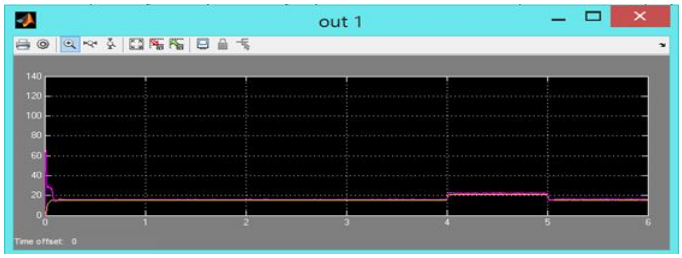
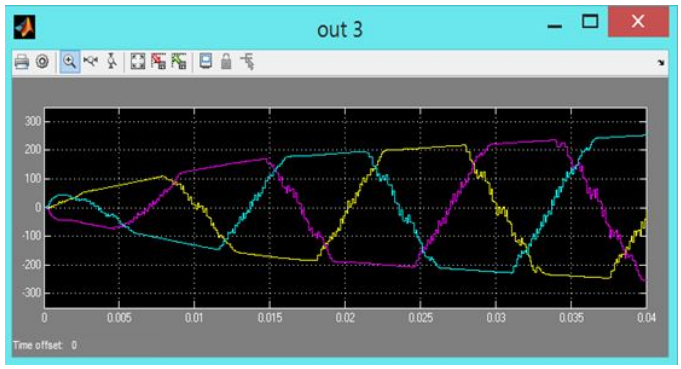
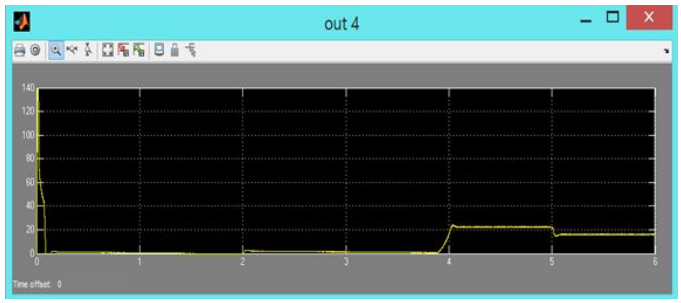


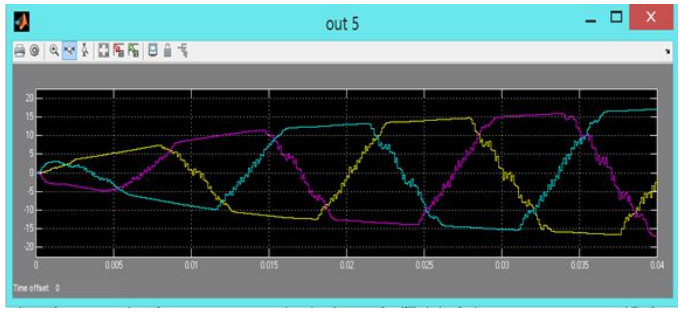
Figure 9: MATLAB Simulink Model of Hybrid Wind-Solar Energy System using MPPT Algorithm

The inverter changes over the DC yield from non-ordinary vitality into valuable AC control for the associated burden. This mixture framework works under ordinary conditions which incorporate typical room temperature on account of sunlight based vitality and typical breeze speed at plain zone on account of wind vitality. The reenactment results are exhibited to delineate the working guideline, achievability and unwavering quality of this proposed framework.









IV. CONCLUSION

Sustainable power sources additionally called non-ordinary kind of vitality are constantly renewed by regular procedures. Crossover frameworks are the correct answer for a perfect vitality creation. Hybridizing sun powered and wind control sources give a practical type of intensity age. Here, a half breed wind and sunlight based vitality framework with a converter topology is proposed which makes utilization of Cuk and SEPIC converters in the plan. This converter configuration defeats the disadvantages of the prior proposed converters. This topology enables the two sources to supply the heap independently or all the while relying upon the accessibility of the vitality sources. MPPT control is accomplished for PV and wind vitality so greatest power is followed and framework work all the more dependably and productively. This framework has lower working expense and discovers applications in remote zone control age, steady speed and variable speed vitality change frameworks and provincial zap. MATLAB/SIMULINK programming is utilized to demonstrate the PV board, wind turbine, DC-DC converters, MPPT controller and proposed crossover framework.

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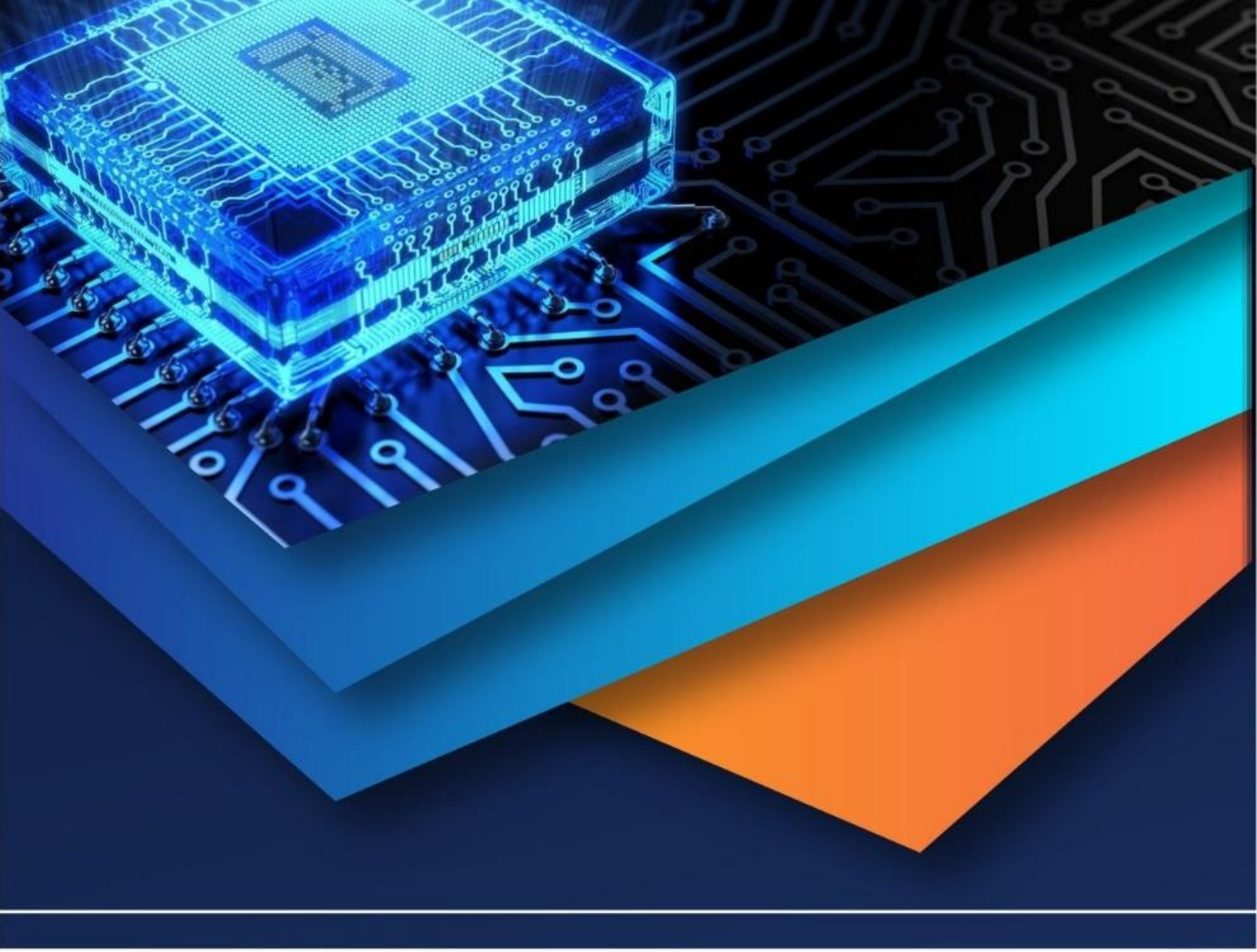

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