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MPPT Implementation of Ultra Capacitor based DVR for Power Quality Enhancement

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Abstract: Power quality is an umbrella concept for multitude of individual types of power system disturbances. Quality of Supply may be categorized. However, in practice, power systems, especially distribution systems, have numerous nonlinear loads, which significantly affect the quality of the power supply. As a result of these nonlinear loads, the purity of the supply waveform is lost in many places. This ends up producing many power quality problems. An important percentage of all power quality problems are of the voltage -quality type where what matters is the deviation of the voltage waveform from its ideal form. The best known disturbances of the voltage waveform are voltage sags and swells, harmonics, inter harmonics and voltage imbalances.

I. INTRODUCTION

A. *General Introduction*

Power quality is a very important issue due to its impact on electricity suppliers, equipment manufactures and customers. “Power quality is described as the variation of voltage, current and frequency in a power system. It refers to a wide variety of electromagnetic phenomena that characterize the voltage and current at a given time and at a given location in the power system”. Both, electric utilities and end users of electrical power are becoming increasingly concerned about the quality of electric power. Sensitive loads such as computers, programmable logic controllers (PLC), variable speed drives (VSD)-etc. need high quality supplies.

B. *Objective Of The Work*

1) Dynamic Voltage Restorer (DVR) can provide the most cost effective solution to mitigate voltage sags and swells by establishing the proper voltage quality level that is required by customer.
2) When a fault happens in a distribution network, sudden voltage sag will appear on adjacent loads.
3) DVR installed on a sensitive load, restores the line voltage to its nominal value

C. *Organiszation Of The Report*

The basic concept about the dynamic voltage restorer using to improve the power quality for using fuzzy logic controller are discussed to the following chapters. The chapters are organized in the manner such that to give the broad idea about the quality problem issues input and output simulation models with the help of MATLAB software.
The project report is divided into 7 chapters which are described as follows:

II. LITERATURE SURVEY

A. *M. R. Hans and N. B. Bhagwat, "Implementation of Switched Mode Power 2020*

Now a days industries demands drives operating at variable speed. In variable speed ac drives, due to the intermittent switching of power electronic switches, large amount of current is drawn from the line which results in energy deficiency, large rating of machine and increase system operating cost

B. *M. T. L. Gayatri and A. M. Parimi, "Multi Microgrid Power Quality Enhancement using Distribution Power Conditioner," 2019*

Less utilization of rating of power converters in renewable energy system forces the researchers to develop new applications like power quality improvement. Power pollution is the key problem because of distorting or non-linear loads and distributed generation.

C. V. Nakade and S. Patil, "Implementation of Power Quality Enhancement using Hybrid Series Active Filter," 2019

Therefore, this aims at proposing a system with a control strategy that can give a fast and reliable wanted response during the operating condition of the system varies. In this paper, we consider the main reasons of power quality deterioration in low-voltage networks.

D. N. Karelia, A. V. Sant and V. Pandya, " Enhancement in Grid Integrated Renewable Energy Sources," 2019

This presents a detailed comparison of design and operational aspects of two UPQC topologies, namely (i) UPQC- Multiconverter, and (ii) UPQC-Distributed Generation.

III. EXISTING SYSTEM

A. Introduction

This method deals with the problems of voltage sag and swell in distribution system and also presents the integration of UCAP-DVR. To achieve fast and precise compensation Fuzzy Logic Controller (FLC) is used along with UCAP-DVR. The UCAP is integrated into the DC link of DVR via bidirectional DC-DC converter designed to operate in buck and boost mode. In addition, UCAPs have high power density and low energy density ideal characteristics for effective compensation of PQ problems such as voltage sag and voltage swell investigating the high quality of power in the distributed power generation.

B. Existing Method

One of the major problems observed in distribution system in recent days is Power Quality. Power quality problem is an occurrence manifested as a non-standard voltage, current or frequency. Utility distribution networks, sensitive industrial load and critical commercial operation suffer from various types of outages and service interruptions that can cost significant financial losses.

1) Block Diagram

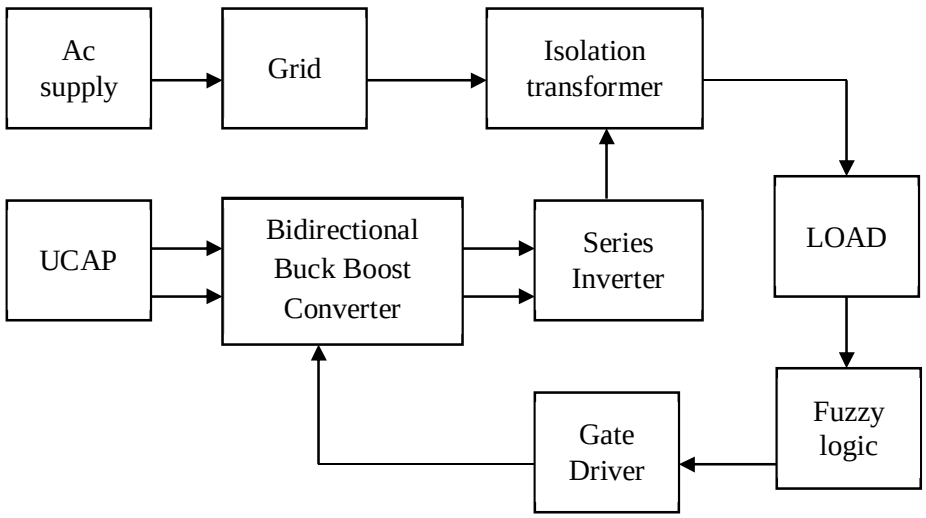

Figure 3.2.1: existing Block Diagram

2) Block Diagram Explanation: It consists of DVR, a bidirectional DC-DC converter connected with UCAP energy storage device. DVR is a Voltage Source Inverter (VSI) which is put in series between the supply and a critical load at the point of common coupling through the injection transformer.

C. Disadvantages

1) Cannot detect condition between fraudulent and fraudulent
2) Needs expert to periodically evaluate attribute importance weight
3) Can detected the tendency weight of the sop detection

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IV. PROPOSED METHOD

A. Introduction

Power system is facing many power quality issues. The various reasons for these powerQuality problems are voltage fluctuations, harmonics, transients and reactive power demands. The results are analyzed using MATLAB Simulink Software.

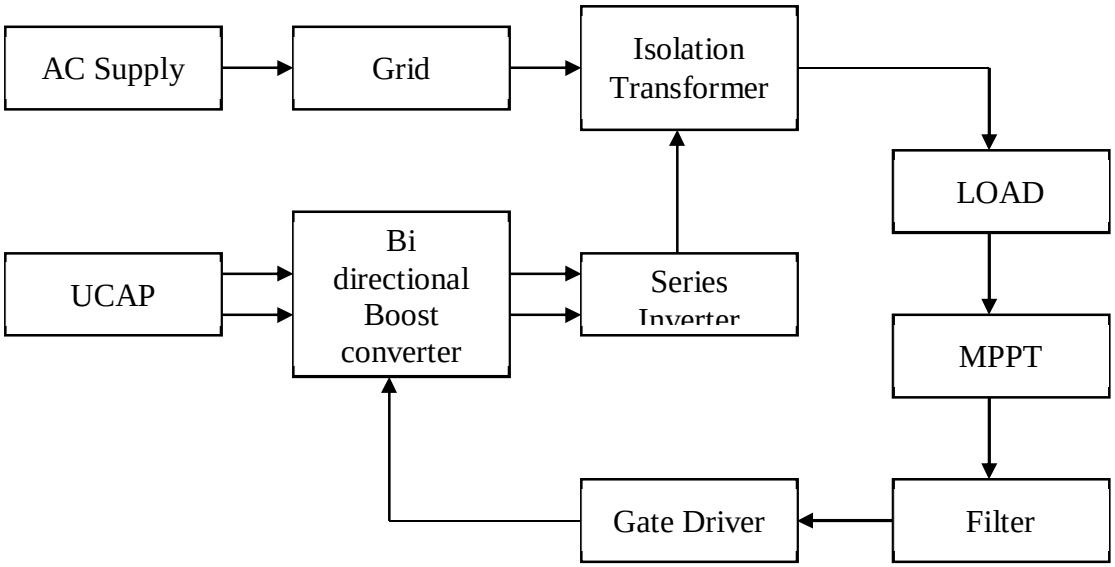

Figure 4.1: proposed block diagram

B. Block Diagram Explanation

UPQC is also called by various names such as universal power quality conditioning system, the universal active filter, universal active power line conditioner. Construction wise UPFC and UPQC are quite similar to each other.

C. Proposed Configuration

This project existing the Dynamic Voltage Restorer as an effective custom power device to mitigate the Voltage Sag and Swell. The mitigation Capability of DVR depends on the maximum load and limited by the energy storage capacity. The Simulation results clearly show the performance of DVR in mitigating Voltage Sag and Swell. From result it is also observed that for increasing load demand the DC energy storage capacity also increases. The DVR handles both balanced and unbalanced situations without any difficulties and injects the appropriate voltage component to correct rapidly any anomaly in the supply voltage to keep the load voltage balanced and constant at the nominal value.

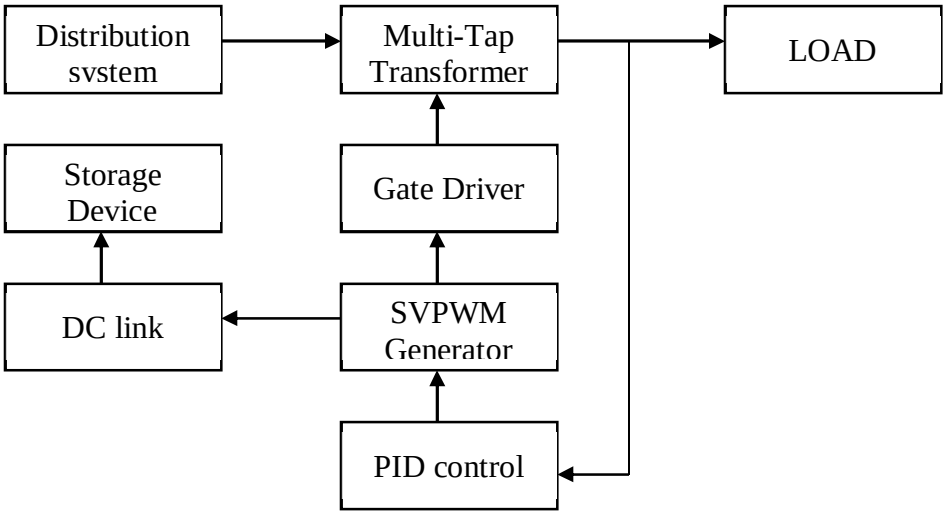

Figure 4.3: proposed configuration

1) Proposed Circuit Diagram

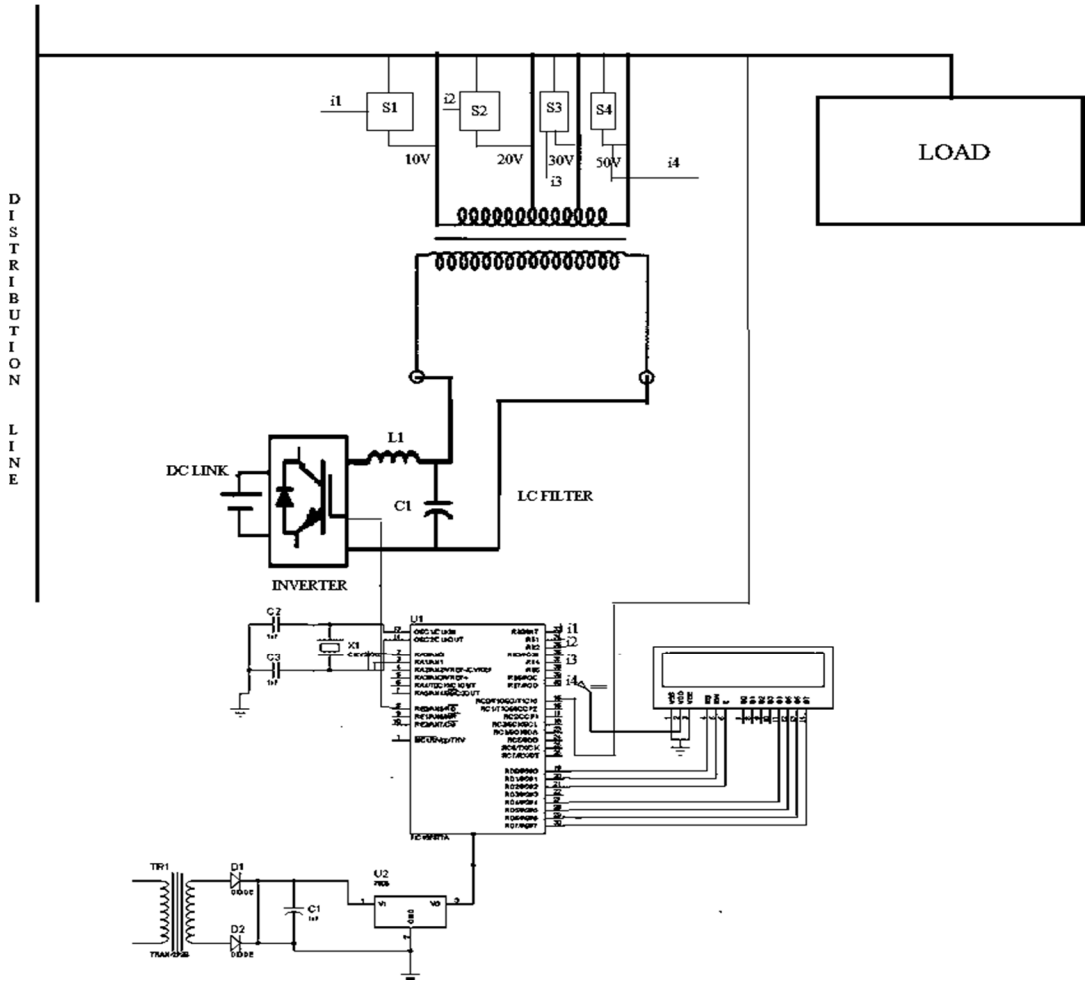

Figure 4.3.1: proposed circuit diagram

V. SOFTWARE REQUIREMENT

A. Introduction To Matlab

Simulink is a block diagram environment for multi domain simulation and Model-Based Design. It supports system-level design, simulation, automatic code generation, and continuous test and verification of embedded systems. Simulink provides a graphical editor, customizable block libraries, and solvers for modeling and simulating dynamic systems. It is integrated with MATLAB, enabling you to incorporate MATLAB algorithms into models and export simulation results to MATLAB for further analysis.

B. Simulation And Model-Based Design

1) Key Features

a) Graphical editor for building and managing hierarchical block diagrams
b) Libraries of predefined blocks for modeling continuous-time and
c) Discrete-time systems
d) Simulation engine with fixed-step and variable-step ODE solvers
e) Scopes and data displays for viewing simulation results
f) Project and data management tools for managing model files and data
g) Model analysis tools for refining model architecture and increasing
h) Simulation speed
i) MATLAB Function block for importing MATLAB algorithms into models
j) Legacy Code Tool for importing C and C++ code into models

2) Model Based Design Process

There are six steps to modeling any system:

a) Defining the System
b) Identifying System Components
c) Modeling the System with Equations
d) Building the Simulink Block Diagram
e) Running the Simulation
f) Validating the Simulation Results

3) Running The Simulation

After you build the Simulink block diagram, you can simulate the model and analyze the results. Simulink allows you to interactively define system inputs, simulate the model, and observe changes in behavior. This allows you to quickly evaluate your model.

C. Open The Simulink Library Browser

You need MATLAB running before you can open the Simulink Library Browser. In the MATLAB Command Window, enter Simulink. The Simulink Library Browser opens.

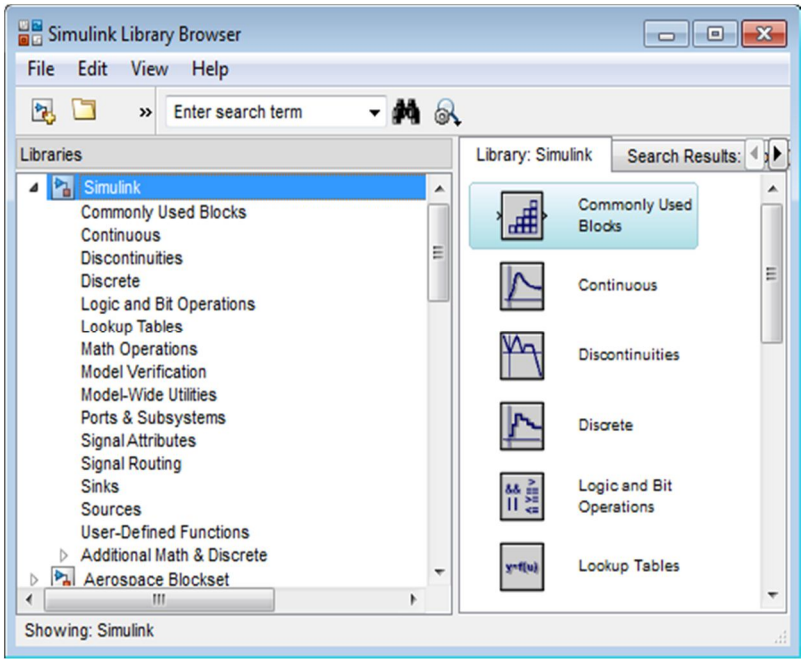

Figure 5.2.9: Simulink Library Browser

D. Open The Simulink Editor

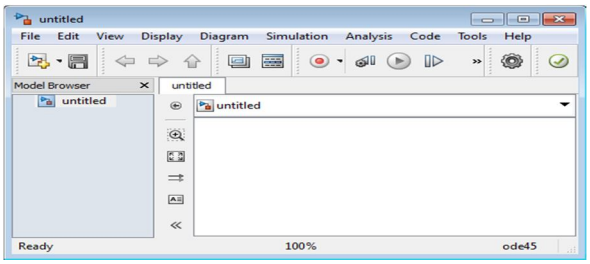

Figure 5.2.9: Simulink Editor

E. Draw Signal Lines Between Blocks

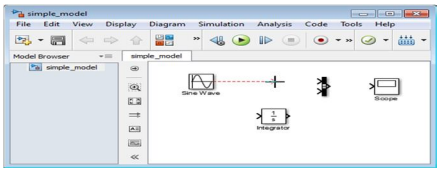

Figure 5.2.9: Draw Signal Lines between Blocks

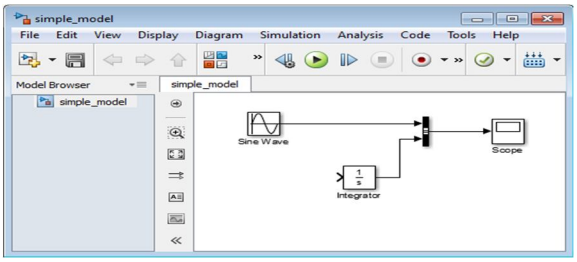

Figure 5.2.9: Draw Signal Lines between Blocks

F. Draw Branched Signal Lines

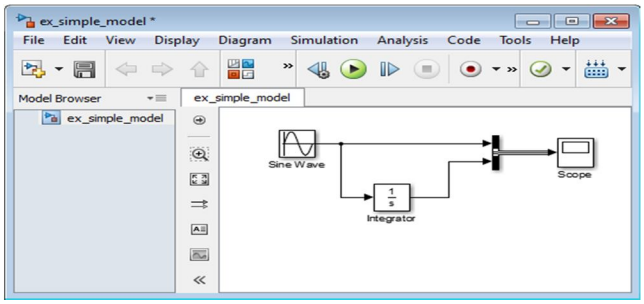

Figure 5.2.10: Draw Branched Signal

VI. SIMULATION OUTPUT

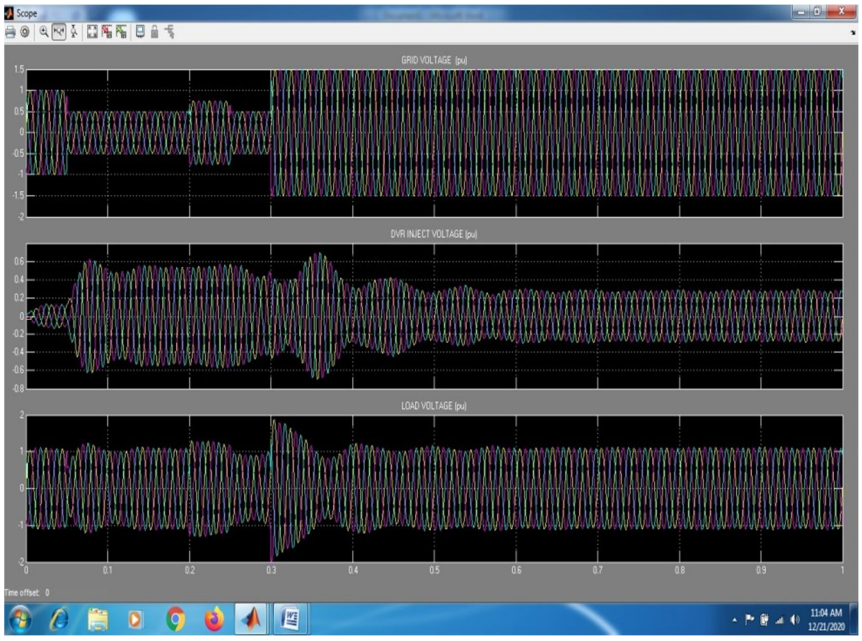

Figure 6.6: Overall Simulation Output

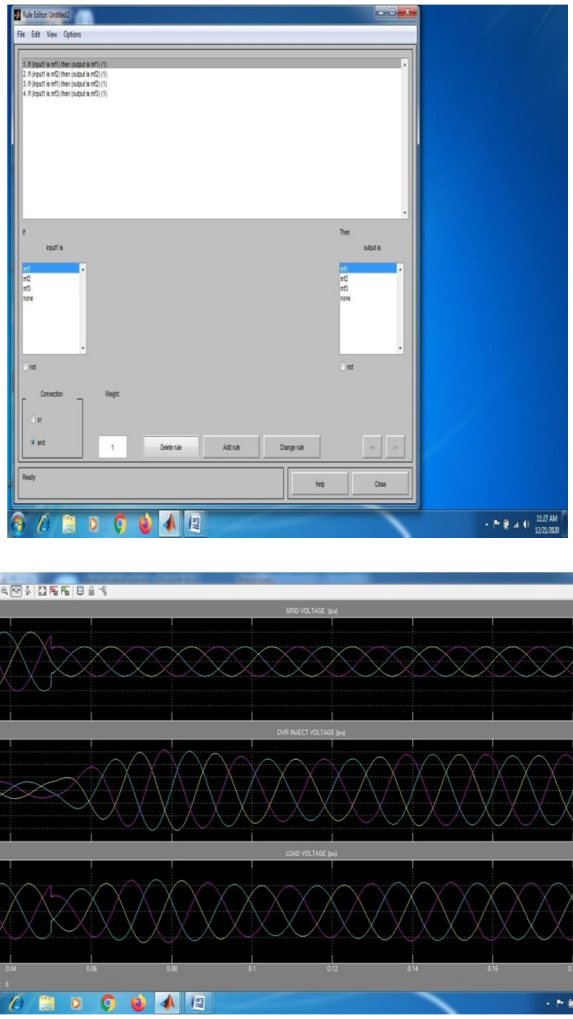

Figure 6.7: Simulation detailed output fuzzy logic controller rules instruct

VII. CONCLUSION

In this paper, a novel integrated UCAP-DVR design was proposed to improve the voltage profile of distribution power system. The proposed model proves that UCAP can be a useful alternative DC source for DVR since it can provide very high power in a short duration of time and to explore the feasibility and stability of the energy storage system which enhances power reliability and energy security in a distribution system. The design and modeling of bidirectional DC-DC converter was discussed as UCAP cannot be directly connected to the dc-link of the DVR. In future, the proposed DVR can be deployed in a micro-grid or a low voltage distribution grid to respond to dynamic changes in the voltage profiles and power profiles on the distribution grid in a smart grid scenario.

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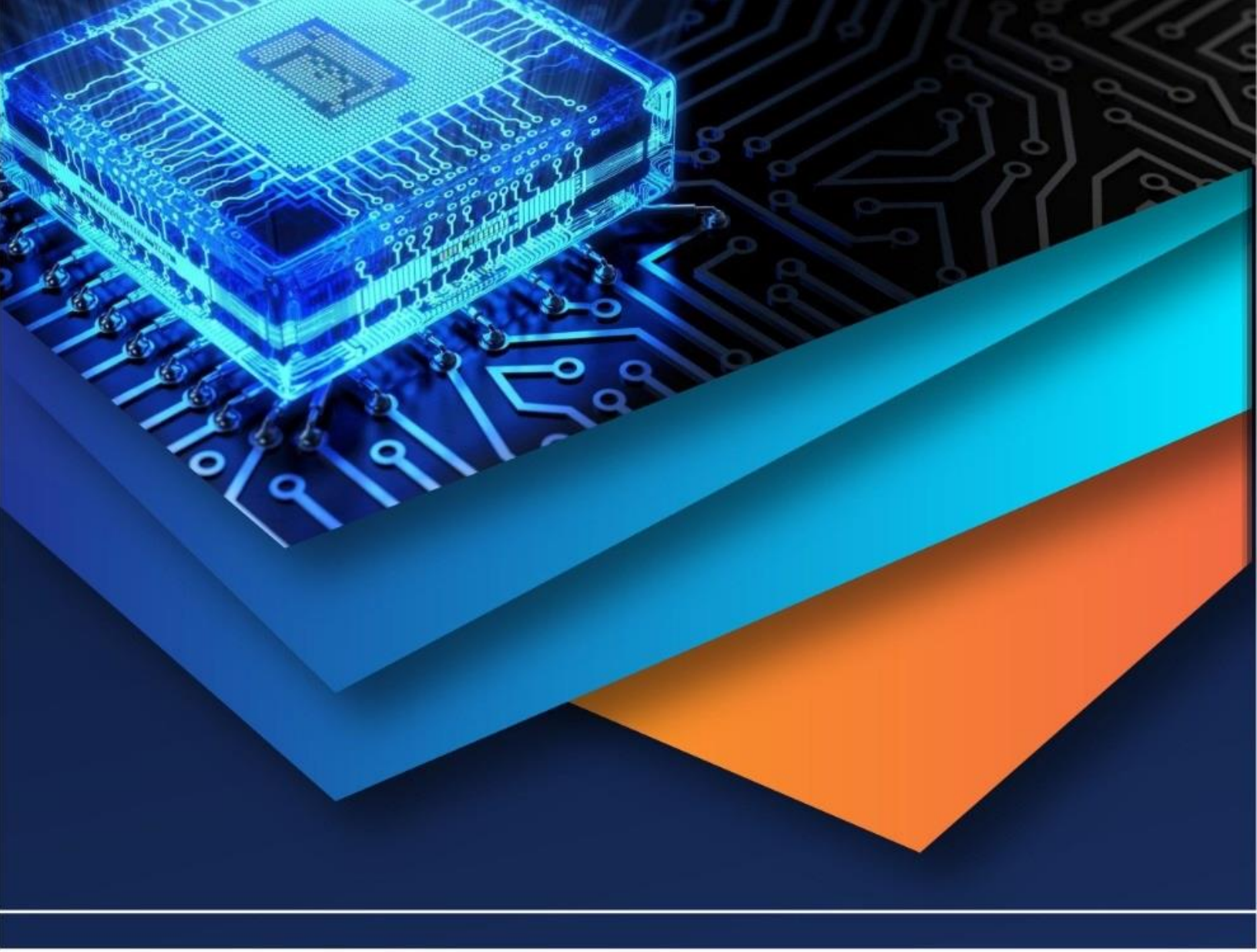

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