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Wind Energy Generating System using STATCOM for Power Quality Improvement

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Abstract: ***When the alternative energy is connected to AN electrical grid, it affects the ability quality. Power quality is measured in terms of active power, reactive power, variation of voltage, flicker, harmonics and electrical behaviour of shift operations. The installation of rotary engine with the grid causes several power quality problems, resolution that's planned throughout this paper. Static compensator (STATCOM) with electric battery energy storage system (BESS) is used at the aim of common coupling to mitigate the ability quality problems. The active power filter improves the system power quality by injecting equal-but opposite currents to compensate harmonic distortion and reactive power. Ideally, this active power filter have to be compelled to monitor and minimize voltage and current distortions of its connected load. Thus on enhance the drawbacks of the standard IRP theory, a direct active and reactive power theoretical the management strategy of the active power filter projected.***
Keywords: International electro-technical commission (IEC), power quality, wind generating system (WGS).

I. INTRODUCTION

Designing methodology of statcom is designed by employing grid connected circuit designed as per the circuit which is connected for the improvement of power quality. The proposed methodologies of wind energy generating system is explained in detailed along with the block diagram and with their switching circuit and also simulation method is also shown below.

A. Static Voltage Controller Along With Thyristor Switch Capacitor And Thyristor Controller Resistor

In this method there is a possibility of getting voltage harmonics because of heavy load interaction between the system and the SVC capacitor bank. To reduce the voltage harmonics we use TSE-TCR this methods is very flexible for rapid switching of the capacitor banks without any disturbance in the power system. Voltage transients can also be reduced by using this SVC controller, higher voltage harmonics can also be avoided. This system much advantageous in case of switching and control complexity.

B. Power Quality

Power Quality is commonly outlined because the electrical network's or the grid's ability to provide a clean and stable power supply. In different words, power quality ideally creates an ideal power provide that's perpetually obtained. Contains a pure noise-free curving waveform, and are usually at intervals voltage and frequency tolerances. However, with increasing and ranging energy demands from numerous industrial processes several hundred often impose disturbances on the grid creating deviation from these ideal conditions are frequent.

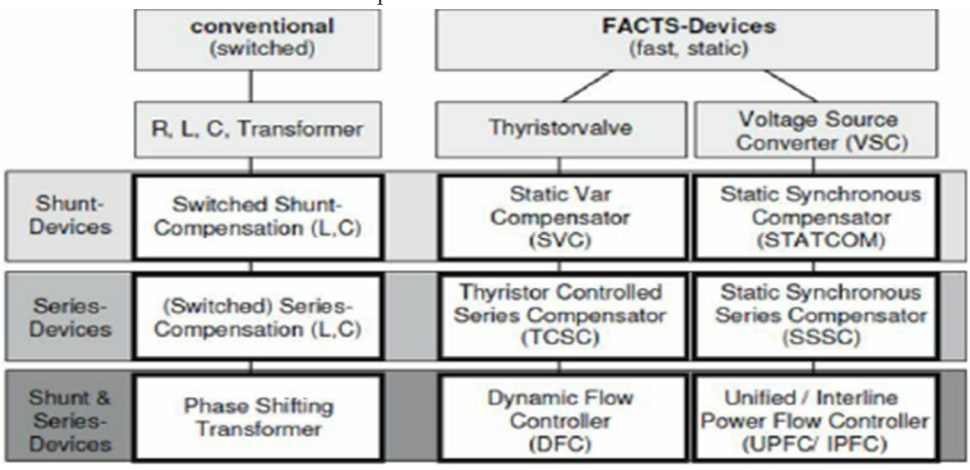

Fig 1: Overview of major FACTS devices

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C. Customer Solutions

MG sets typically utilize flying wheels for energy storage. motility energy within the regulator provides voltage regulation and voltage support throughout below voltage conditions. UPSs utilize batteries to store energy that is reborn to usable type throughout Associate in Nursing outage or voltage sag. CVT's square measure essentially transformers that square measure excited high on their saturation curves, thereby supply output voltage that is fairly freelance of input.

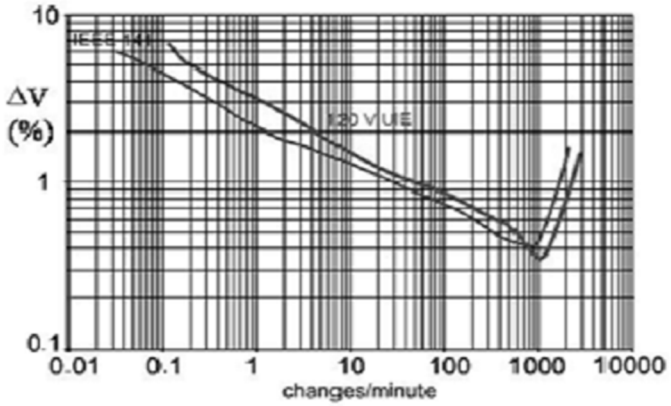

Fig 2: SVC Building blocks and voltage / current characteristic.

II. CONFIGURATIONS OF FACTS DEVICES

In a network, a switched virtual circuit (SVC) may be a temporary virtual circuit that's established and maintained just for the period of an information transfer session. A permanent virtual circuit (PVC) may be a incessantly dedicated virtual circuit. A virtual circuit is one that seems to be a separate, physical circuit accessible solely to the user however that's really a shared pool of circuit resources accustomed support multiple users as they need the connections. Switched virtual circuits area unit a part of associate X.25 network. Conceptually, they'll even be enforced as a part of a frame relay network.

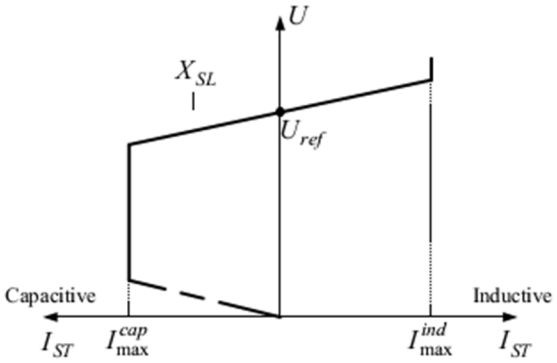

Fig 3: STATCOM structure and voltage / current characteristic

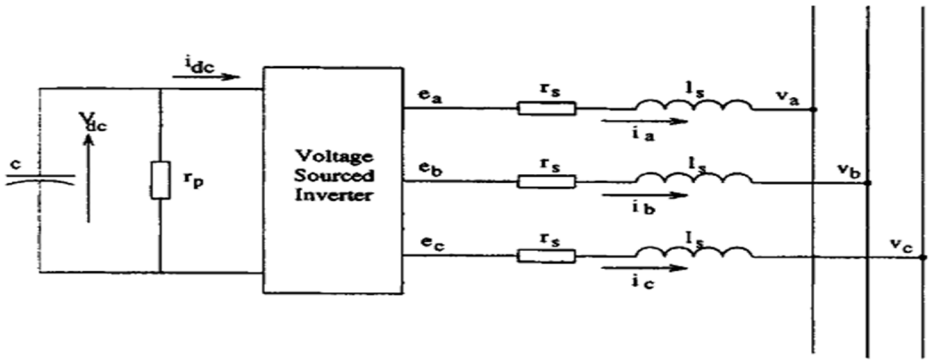

Fig 4: STATCOM equivalent circuit

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This configuration is that the vital harmonics that may be generated attributable to the partial physical phenomenon of the big reactor below traditional curved steady-state operational condition once the svc is gripping zero MVAR.
These harmonics area unit filtered within the following manner. Ternary harmonics area unit off by arrangement the TCR and therefore the secondary windings of the transformer in delta association. The electrical device banks with the assistance of series reactors area unit tuned to filter fifth, seventh, and alternative higher-order harmonics as a high-pass filter. Additional losses area unit high because of the current between the reactor and electrical device banks.

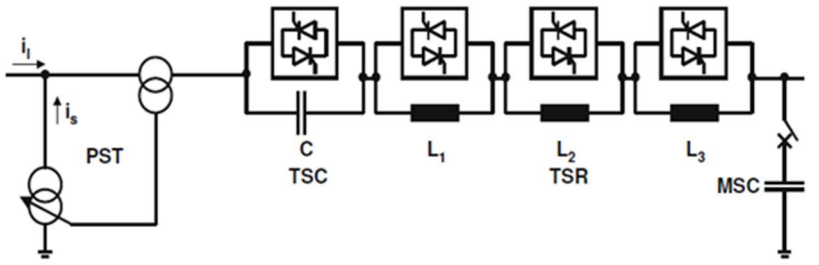

Fig 5: Principal configuration of DFC.

III. UNIFIED POWER FLOW CONTROLLER

Device for providing fast-acting reactive power compensation on high-voltage electricity transmission networks. It uses a try of three-phase governable bridges to provide current that's injected into a cable employing a series electrical device. The management will control active and reactive power flows in an exceedingly cable. third generation of FACTS devices, is out and away the foremost comprehensive FACTS device[2], in installation steady-state it will implement power flow regulation, moderately dominant line active power and reactive power, up the transmission capability of installation, and in installation transient state it will understand fast-acting reactive power compensation, dynamically supporting the voltage at the access purpose and up system voltage stability, moreover, it will improve the damping of the system and power angle stability.

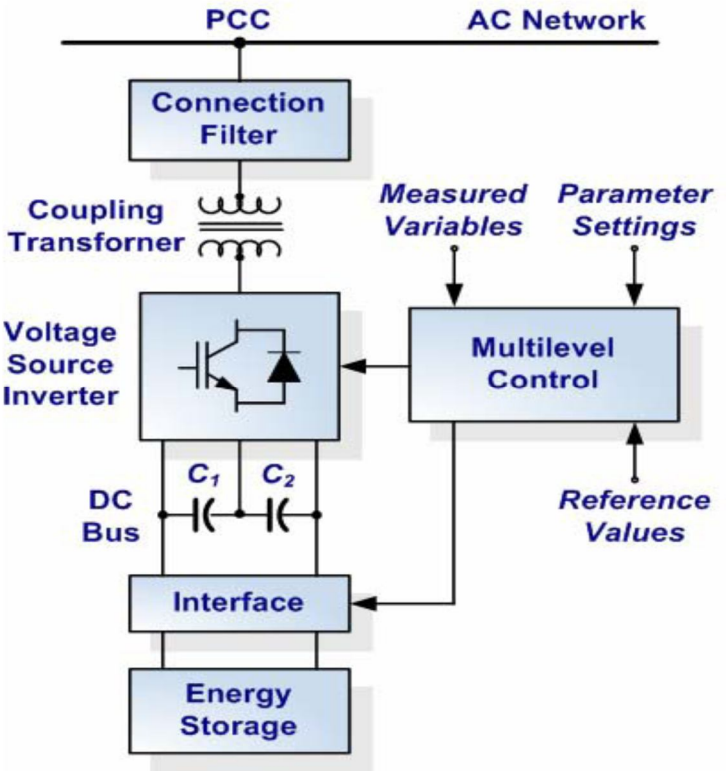

Fig 6: Basic circuit connection of STATCOM

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IV. GRID COORDINATION RULE

The voltage dips is thanks to commence of turbine and it causes a fast reduction of voltage. it's the mass voltage amendment thanks to shift operation of turbine. The advantage of a statcom is that the reactive power provision is freelance from the particular voltage on the association purpose. this will be seen within the diagram for the utmost currents being freelance of the voltage compared to the svc. This means, that even throughout most severe contingencies, the statcom keeps its full capability.

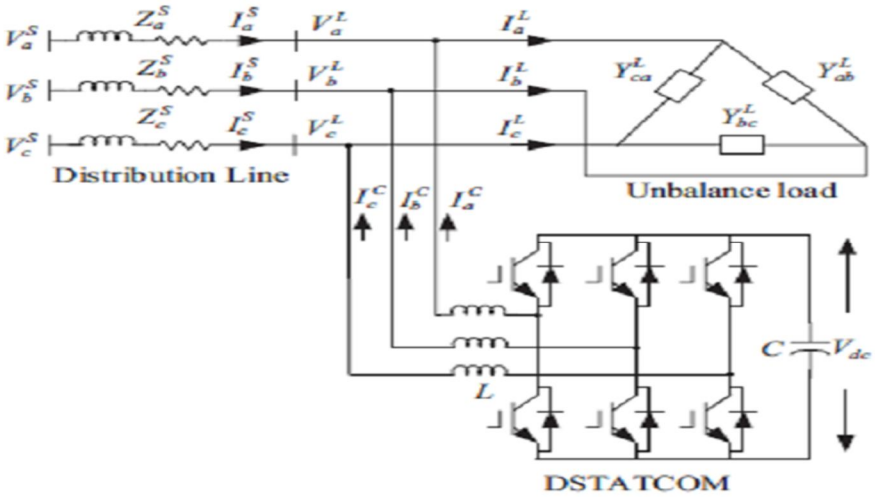

Fig 7: A radial distribution system with an unbalance load and a STATCOM

The BESS is employed as associated energy storage part for the aim of voltage regulation. The BESS can naturally maintain dc converter voltage constant and STATCOM it space injects or absorbed reactive power to stabilize the grid system. Additionally management the distribution and transmission during a in no time. Once power fluctuations happens within the system, The BESS are often accustomed level the ability fluctuation.

V. WIND ENERGY GENERATION SYSTEM

Wind is a kind of energy in which it has uneven heating on the earth surface by the effect of the sun. It absorbs sun's heat during day time and heats up more quickly than air over water. The accessible power of wind energy system is given. where (kg/m) is that the air density and A (m) is that the area swept out by rotary engine blade, is that the wind speed in mtr/s. it's infeasible to extract all K.E. of wind, therefore it extract a fraction of power in wind, stated as power constant Cp of the rotary engine, and Where Cp is that the ability constant, depends on kind and operational condition of rotary engine. This constant are going to be specific as a perform of tip speed relation and pitch angle. The mechanical power prove by rotary engine is given.

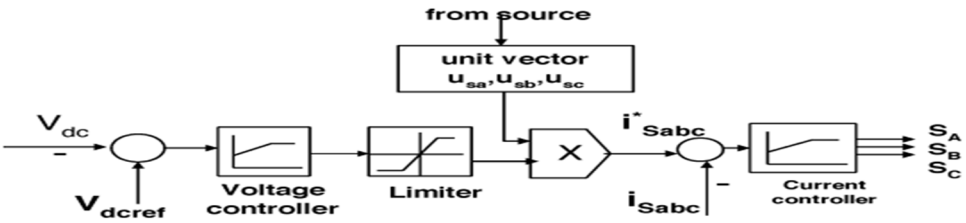

Fig 8 Block diagram of the proposed Control Scheme

VI. SIMULATION RESULTS

The designed methodologies of proposed wind energy generating system and STATCOM which is grid connected the wave forms of voltage and current wave forms can be studied in detailed below. In the voltage waveform the ac voltages are in phase with trhe phase voltages along with the RMS values which is proportional to the magnitude of source voltage with respect to the source current which sinusoidal in nature. The method used in STATCOM is very simple without any complexity the source current in STATCOM is always source voltage. In the grid connected system the waveforms are in synchronization with both voltage source and current source.

The dynamic performance is additionally distributed by step amendment during a load, once applied at one.0 s. this extra demand is fulfil by STATCOM compensator. Thus, STATCOM will regulate the out there real power from supply. The results of supply current, load current square measure shown in Fig. 6(a) and (b) severally.

A. Simulink Diagram Of Proposed Topology

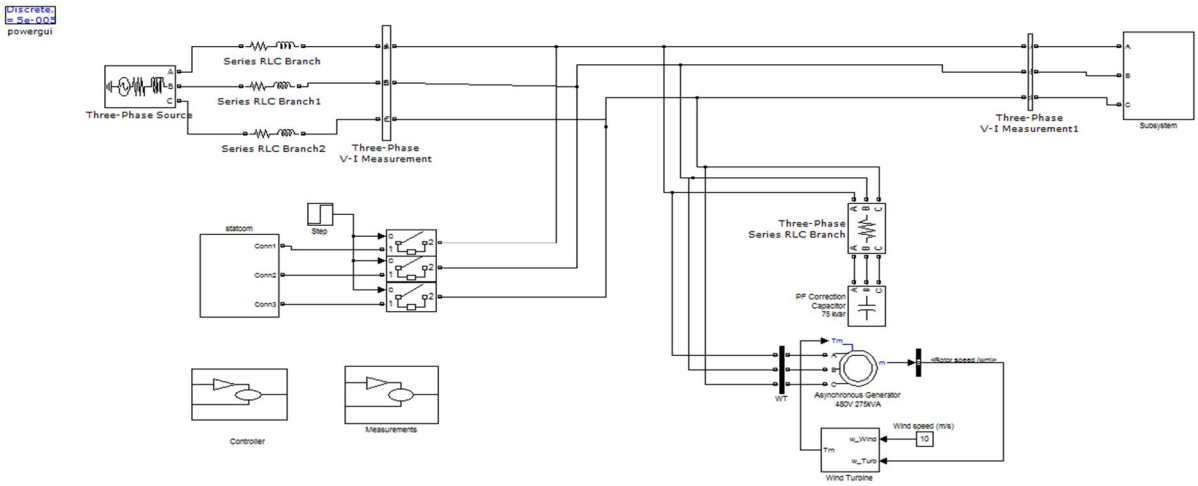

Fig.9: Grid connected system for power quality improvement.

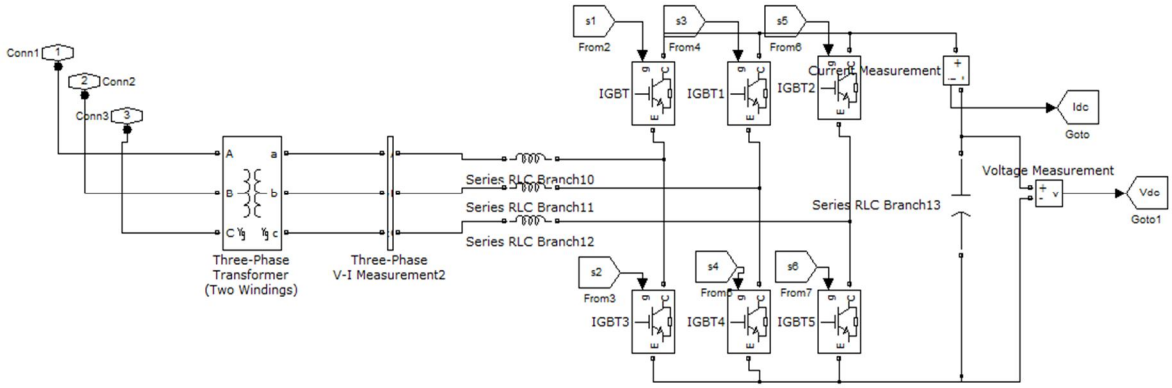

Fig.10: STATCOM Circuit for Grid connected system

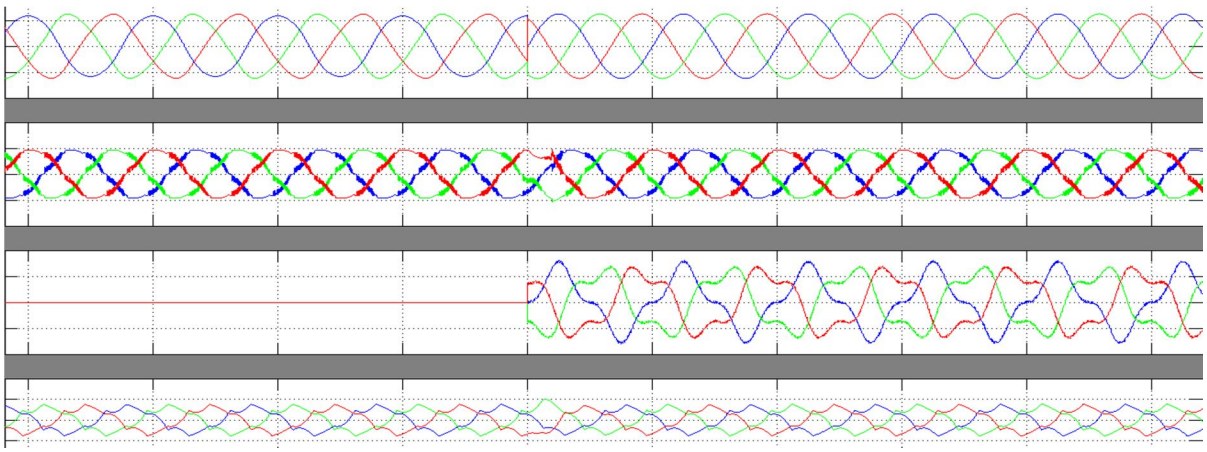

Fig.11: (a) Source Current. (b) Load Current. (c) Inverter Injected Current. (d) Wind generator (Induction generator) current.

VII. CONCLUSION

STATCOM management theme for power quality improvement in grid connected alternate energy system with non linear load parts. the standard of power problems on the patron and electrical utility. The operation system for STATCOM and BESS in SIMULINK maintaining power quality.

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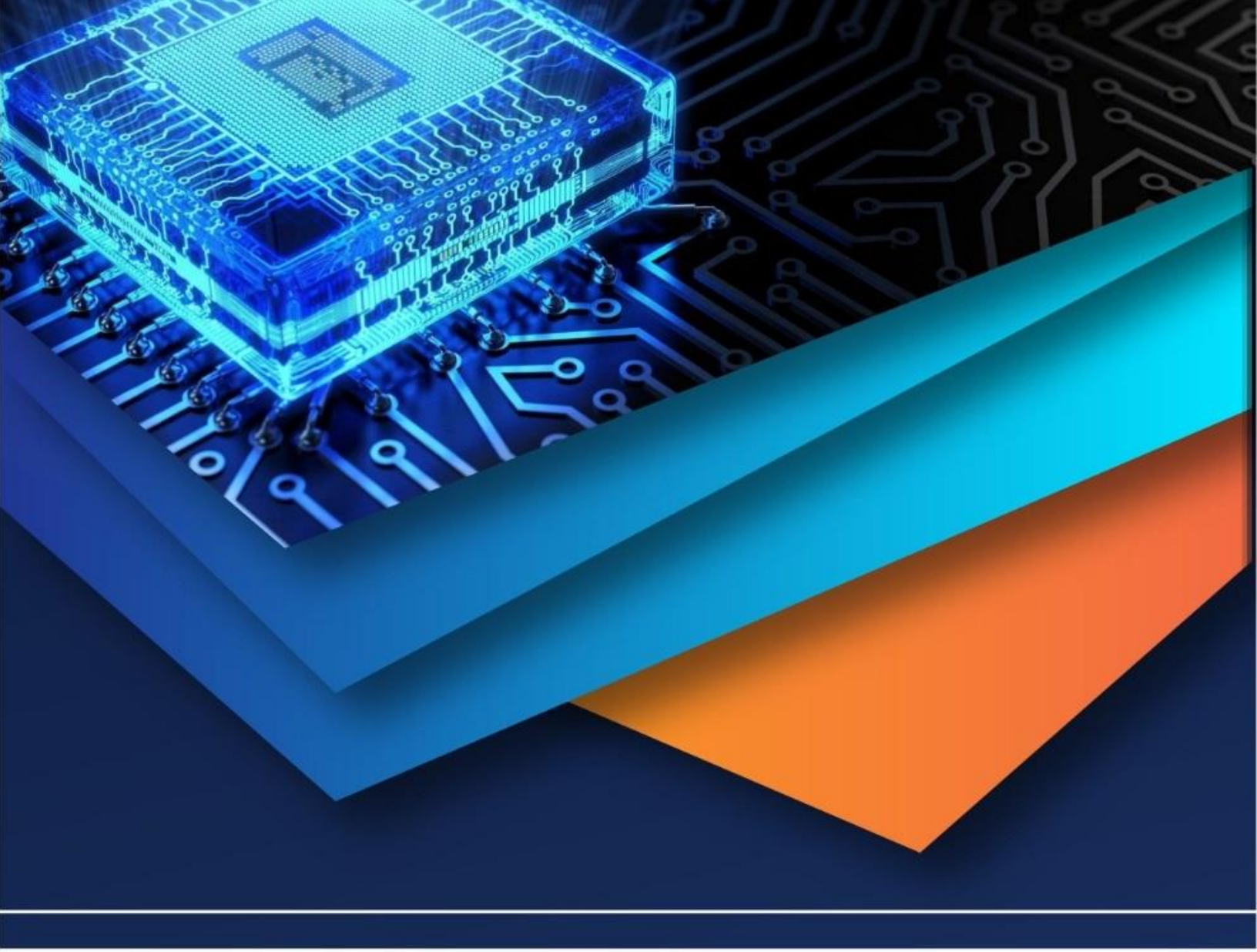

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