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Carrier Inferrometric Code Based Variable Rate Transmission Schemes for Satellite Communication System

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Abstract*: *The development of global satellite communication, spread spectrum communication has also been widely used in satellite communication system. Multicarrier Code Division Multiple Access (MC-CDMA) is a promising approach to the challenge of providing high data rate in mobile satellite communication.MC-CDMA is an emerged as powerful alternative to conventional Direct Sequence Code Division Multiple Access(DS-CDMA). Carrier inferrometric complex spreading code is assigned as unique, orthogonal codes for multiple user. Assuming a frequency selective Rayleigh fading channel however, MC-CDMA is a spread spectrum technology has some many challenges to address. such a Multiple Access Interference, receiver complexity, BER. CI/MC-CDMA which suppress MAI, by SIC which make full use of the bandwidth. Using Carrier Inferrometric Code(CIC) which reduce the receiver complexity.
Keywords: CDMA, MC-CDMA, MAI, SIC, CIC, DS-CDMA

I. INTRODUCTION

According to the CDMA Development Group (CDG), Code Division Multiple Access (CDMA) technology is a base for all wireless networks around the globe and there were 431 million CDMA subscribers and 91million CDMA 2000 1x subscribers worldwide by the end of the year 2007.

It is believed that there will be many operators who will regard the HSPA+ and EV-DO Rev B path as an easier and safer way into higher data rates. HSPA+ is considered cheaper than a move to LTE since LTE is based on MC-CDMA and a number of new components will be required. It is expected that by the year 2017, mobile MC-CDMA solutions such as LTE, UMB and mobile WiMAX will only account for 6.4% of the global number of cellular subscriber.

The paper is organized as follows. In Section 2, A Quantum Genetic Algorithm (QGA) is explained. In Section 3, Existing system is presented. In Section 4, Working methods of proposed QGA system is described. In Section 5, we give the Comparison between AES and QGA is discussed. In Section 6, we conclude the paper.

II. MULTI-CARRIER CODE DIVISION MULTIPLE ACCESS (MC-CDMA)

Multi-Carrier Code Division Multiple Access (MC-CDMA) is a scheme used in MC-CDMA based telecommunication systems. Allowing the system to support multiple users at the same time.

MC-CDMA and multiplexed MC-CDMA on the basis of which domain Direct Sequence Spreading takes place, there are also two alternative schemes which are (a) Time-spreading MC-CDMA and (b) Frequency-spreading MC-CDMA. Therefore, we will have four different MC-CDMA systems.

A. Orthogonal MC-CDMA

MC-CDMA is a spread spectrum technique, but we apply the spreading in the frequency domain (rather than in the time domain as in Direct Sequence CDMA).

1) It is a Direct Sequence CDMA, but after spreading, a Fast Fourier Transform (FFT) is performed.
2) It is a Orthogonal Frequency Division Multiplexing (OFDM), but we first apply an orthogonal matrix operation to the user bits. Therefore, MC-CDMA is sometimes also called "CDMA or MC-CDMA".
3) It is a Direct Sequence CDMA, but our code sequence is the Fourier Transform of a Walsh Hadamard sequence.
4) It is a form of frequency diversity as in fig.1. Each bit is transmitted in parallel on many different subcarriers. Each subcarrier

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has a (constant) phase offset. The frequency offsets form a code to distinguish different users.

B. Objective Of The Work

In order to overcome the problem of multiple access interference between multiple users within the same channel, unique spread code generation based multiple user detection technology is proposed with the basic idea of processing all user information as useful information along with successive and parallel interference cancellation.

III.EXISTING SYSTEM

WCDMA stands for Wideband Code Division Multiple Access. It is used for 3G, mobile communication networks. The term is often used with Universal Mobile Telecommunications Systems(UMTS). Technically WCDMA is merely one example of UMTS technology The system also uses power control. This adjusts the signal strength transmitted by each cell phone. So that it reaches the nearest transmitter at the same strength, regardless of how far away the phone is. This avoids the transmitter getting signals which are excessively strong or weak, which could limit the transmitter's efficiency.

The main demerits of WCDMA are that it is not used throughout the entire world, which limits take-up of compatible handsets among people who travel internationally, and that it is a relatively complex system which can be expensive to introduce into a new market.

A. Parallel interference cancellation is used at receiver side as a detector.

B. Gold code or Walsh code is used for spreading process in CDMA technique for multiband transmission for multiple users.

C. Joint detection(spreading sequence, phase & delay) is carried out to separate user data during de-spreading at receiver side.

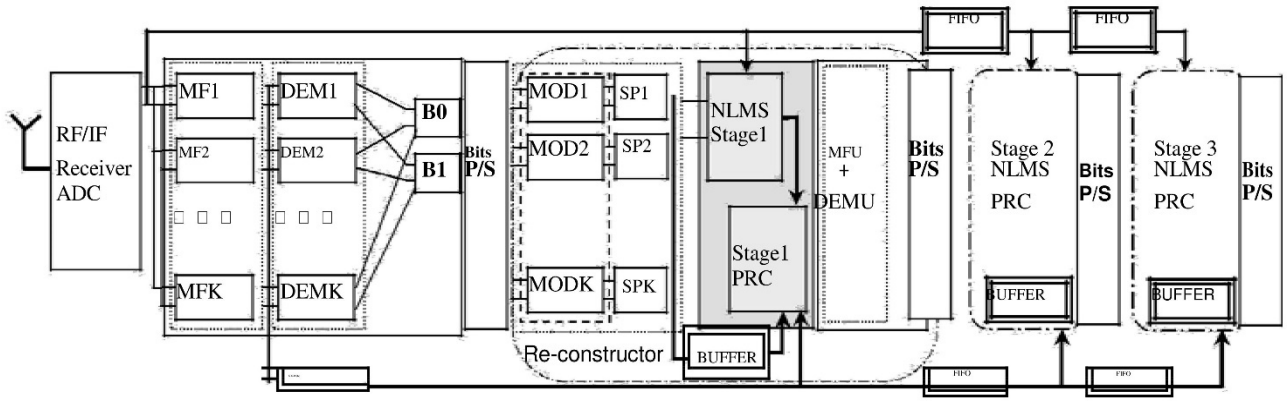

Fig. 1. System-level architecture for the multi-stage NLMS PRC receiver with multi-code matched filter as the initial stage.

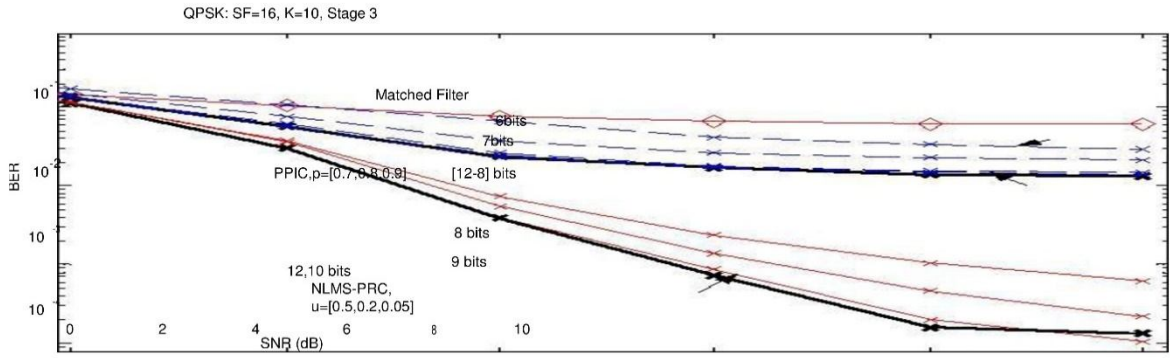

Fig. 2. Fixed point implementation BER vs. SNR. Simulation result

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IV. PROPOSED SYSTEM

Data rate of 4G standard is achieved by designing the transceiver efficiently and low power architecture for the FFT and IFFT blocks in a Multi-Carrier Code Division Multiple Access (MC-CDMA) will be presented.

It is possible to reduce the power consumption further by dynamically reducing the complexity of the receiver architecture in real time as per the changing channel requirements like the delay spread, signal-to-noise ratio (SNR), bandwidth, bit error rate,etc., The proposed method is to alter the FFT size or inverse FFT (IFFT) size in real time as per the channel delay spread instead of using a fixed large FFT-based transceiver designed for the worst-case delay spread.

The need for increasing data rates while maintaining high quality of service is the result of the penetration of digital technology into formerly analog services (e.g. radio and television broadcasting).The demand for mobility in case of typically fixed services (e.g. LAN and Internet access).

A. Block Diagram MC-CDMA Transceiver

The MC-CDMA system includes a transmitter section and a receiver section. The block diagrams of a transmitter and receiver sections are shown below.

B. Transmitter

The transmitter block diagram consists of Signal Mapper, Spreader, Frequency interleaved, IFFT, parallel to serial converter, Guard interval insertion.

C. Serial to Parallel Convertor

When data are sent serially that is one bit at a time, it will be transmitted with a little delay. In order to avoid this delay we convert the serial data into parallel with the help of a serial to parallel converter.

D. Spreader

Spreading module is used to spread out the symbol on each of the plurality of subcarriers by using a direct sequence spread spectrum. The symbols on each of the subcarriers are spreaded by producting the symbols by predefined length sequences. It works by spreading a single data stream over a band of sub-carriers, each of which is transmitted in parallel. After the symbol are mapped to sub-carriers, spreading module spreads out the symbol sequence on each of the parallel flat fading channels The method used here for spreading is Walsh Hadamard Transform.

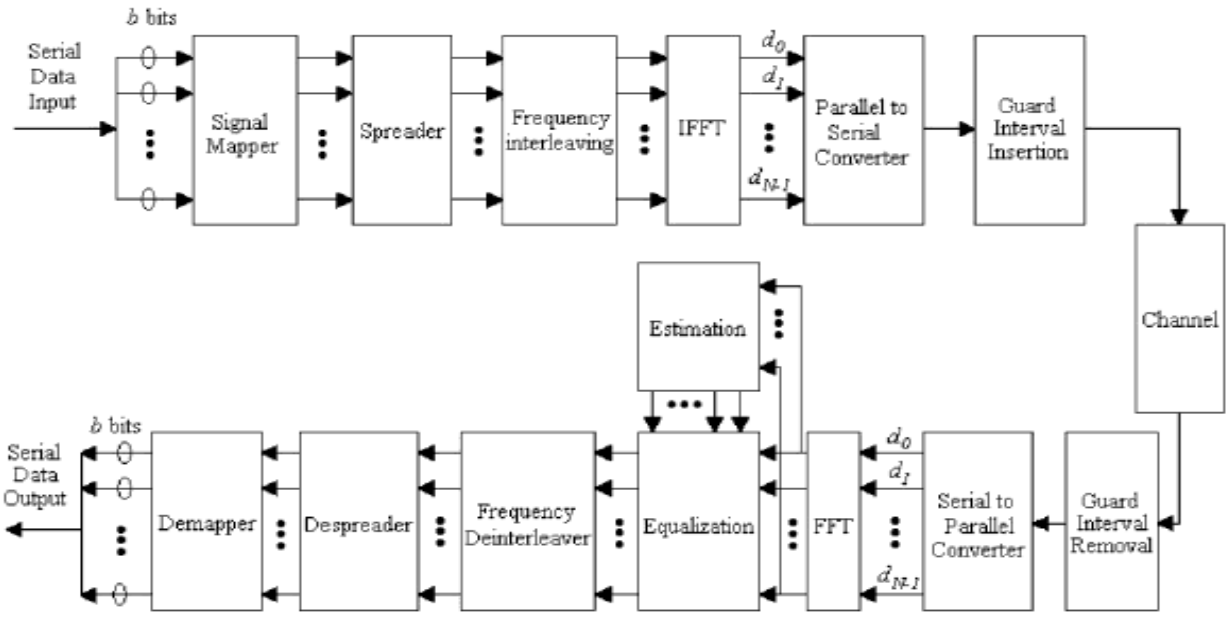

Fig 4. The Block Diagram of Proposed MC-CDMA

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E. Walsh-Hadamard Transform

The Walsh-Hadamard Transform (WHT) is a suboptimal, non-sinusoidal, orthogonal transformation that decomposes a signal into a set of orthogonal, rectangular waveforms called Walsh functions. They are used in many applications, such as power spectrum analysis, filtering, processing speech and medical signals, multiplexing and coding in communications, characterizing non-linear signals, solving non-linear differential equations, and logical design and analysis.

F. Frequency Interleaver

Frequency interleaving is used to exploit the frequency diversity in wide-band transmissions. After frequency interleaving, the local deep fading is averaged over the whole bandwidth of the system.

G. Ifft

IFFT - Inverse Fourier transform processing is carried out on a plurality of parallel signals. This IFFT processing section assigns one subcarrier to one chip data signal string and carries out Frequency division multiplexing. Parallel data streams are used as inputs to an IFFT .IFFT output is sum signal samples IFFT does modulation and multiplexing in one step Filtering and D/A of samples results in baseband signal.

H. Receiver

The receiver consists of a guard interval removal, serial to parallel converter, FFT, Frequency De -interleaver , De -spreader, De - mapper , Parallel to serial converter.

Parallel/serial (here in after referred to as "P/S") converter converts a plurality of parallel signals into a single serial signal. This P/S converter rearrange the subcarrier signals from one chip to another and outputs the 1st chip of a signal on which spread transmission signals 1 to n are multiplexed at time t.sub.1, the 2nd chip of a signal on which spread transmission signals 1 to n are multiplexed at time t.sub.2, . . . up to the kth chip of a signal on which spread transmission signals 1 to n are multiplexed at time t.

I. FFT

An Fast Fourier Tansform (FFT) is an efficient algorithm to compute the Discrete Fourier Transform (DFT) and its inverse. Its a way to compute the same result more quickly: computing a DFT of N points in the naive way, using the definition, takes $O(N^2)$ arithmetical operations, while an FFT can calculate the same result in only $O(N \log N)$ operations.

J. De-spreader

De-spreader module for de-spreading the symbols on each of the plurality of subcarriers.This section carry out despreading processing by multiplying the reception signal which has been converted to a single serial signal by their corresponding spreading codes 1 to n and extracting only the signals spread using those codes.

V. RESULT AND DISCUSSION

A. Performance Analysis of MC-CDMA for BER vs S/N

MC-CDMA produces the high speed data rate which cancel out ISI problem. In the graph, we have used Walsh Codes with CDMA and without MC-CDMA .On the comparison of MC-CDMA analysed that CI/MC-CDMA produce good signal to noise ratio and also compared with theoretical bound value.

Fig.5 Single vs Multi User with Variable Rate

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A. Interference Cancellation

Proposed method is to cancel MAI (Multiple Access Interference) using SIC(Successive Interference Cancellation), where SIC is a method keeping one tap constant and checking iteratively the other sub-carriers. In the graph it shows that performance is improved without and also compared with Walsh Hadamard Spread codes.

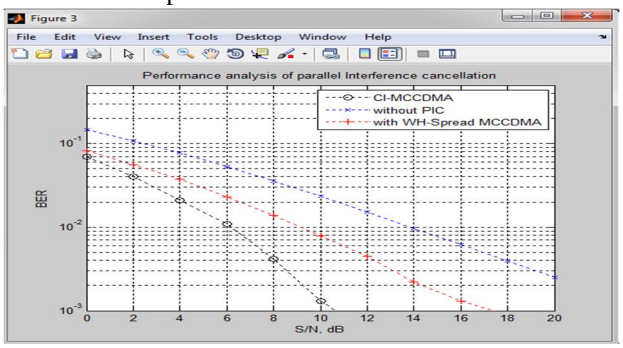

Fig.6 Interference cancellation

B. BER Analysis with Different Users

BER(Bit Error Rate) is number of bits error rate ratio divided by total number of bit transfer.According to the graph Rayleigh Channel is a multi path channel through which multiple users or transmitter same time.In MC-CDMA different users in a channel has reduced BER.In the graph there is no Inter Symbol Interference.

Fig.7 Performance Analyzes

C. BER Analysis on SIC

On using SIC (Successive Interference Cancellation) the receiver complexity is reduced .Comparing with different users the BER is reduced and accuracy of SIC is also high. This leads to good Signal to noise ratio.

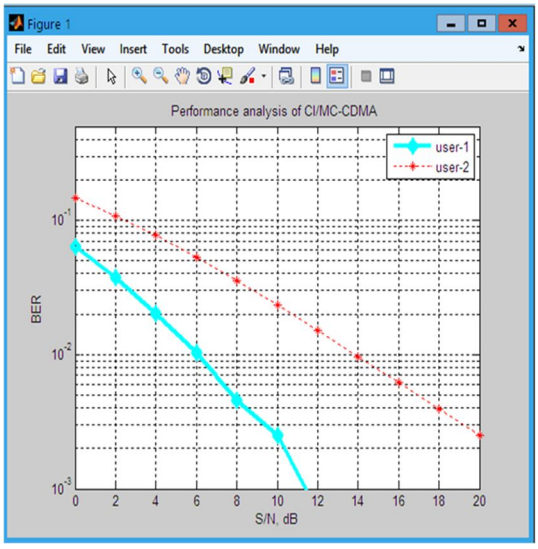

Fig. 8 SIC BER analysis

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VI. CDMA VS PROPOSED MC-CDMA

The following Table 1. shows the comparison between CDMA and MC – CDMA.

Existing System	Proposed System
• CDMA • 2G • Fixed Rate Transmission • Parallel Interference Cancellation • BER 10^-4	• MC-CDMA • 4G • Variable Rate Transmission • Successive Interference Cancellation • BER 10^-2

Table 1. CDMA Vs Proposed MC-CDMA

VII. CONCLUSION

In this work we proved the efficiency of MC CDMA system over a successive multiuser detection technique for Code Division Multiple Access (CDMA) systems. In CDMA system, single-user detection is employed, but in MC CDMA leads MAI interference between users is considered as noise, which contributes to the statistics of detection variables affecting the quality of detection. In this paper carried inferometry spreading code is used for multiuser detection scheme to cancel inter user interference. In multiuser detections, the MAI component is fully eliminated or cancelled by the use of proposed spreading code in the system. The successive multiple user detection algorithms are described for MC CDMA model and the performance for various numbers of users is simulated and evaluated. The performance of successive multiuser detection is compared with that of the single-user detection to show a significant improvement.

The performances can be improved with linear diversity combining techniques operating in a worst case fading environment over dual-branch cases. The error rate performances of dual-branch can be optimized using Adoptive modulation coding format.

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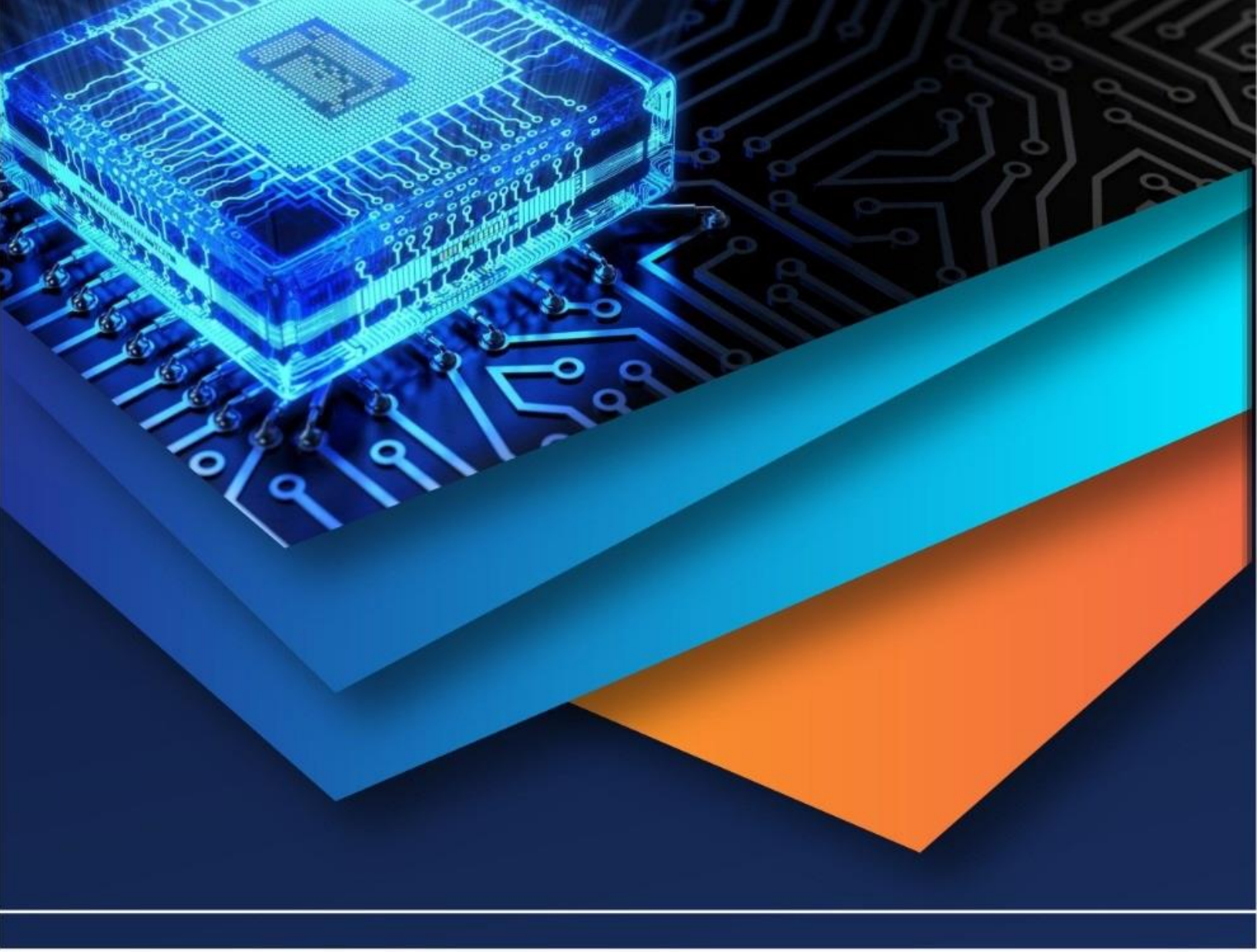

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