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# Channel Estimation for Massive MIMO Systems

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***Abstract:** In MIMO millimeter-wave (mmWave) systems, while the hybrid digital/analog precoding structure provides the ability to increase the reach rate, it also faces the challenge of reducing the channel time limit due to the large number of horns on both sides of the Tx / Rx. . In this paper, channel measurement is done by searching with multiple beams, and a new hierarchical multi-beam search system is proposed, using a pre-designed analog codebook. Performance tests show that, compared to a high-performance system, the proposed system not only achieves a high level of success in getting multiple beams under normal system settings but also significantly reduces channel estimation time*
***Keywords:** Massive MIMO, Channel Estimation, precoding*

## I. INTRODUCTION

With globalization, modern networks face higher traffic requirements, and to meet these needs, cellular systems are used within a few hundred meters, and local area networks (lans) are located almost everywhere. Along with the expansion of mobile broadband service, the introduction of new concepts such as the internet of things (iot) and electronic communications (m2m) also contributed to the increase in wireless traffic.

The worldwide distribution of mobile services enables mobile users to make the most of mobile data in their daily lives. Services such as video streaming, online games, social networking apps such as Facebook, Twitter, WhatsApp, have dramatically changed our lives with the skills of third-generation (3G), fourth-generation (4G), and fifth-generation (5G) networks, such as low latency. and high data rate [1].

Monstrous MIMO is the most charming innovation for 5G and past the remote access time. Monstrous MIMO is the headway of contemporary MIMO frameworks utilized in current remote organizations, which gathers hundreds and even a great many radio wires at the base station and serves several clients all the while. The additional receiving wires that huge MIMO uses will assist with centering energy into a more modest district of room to give better unearthly productivity and throughput. The monstrous MIMO downlink and the uplink framework.

MU-MIMO leverages multiple users as spatially distributed transmission resources, at the cost of somewhat more expensive signal processing. In comparison, conventional single-user MIMO (SU-MIMO) involves solely local-device multiple-antenna dimensions. MU-MIMO algorithms enhance MIMO systems where connections among users count greater than one. MU-MIMO may be generalized into two categories: MIMO broadcast channels (MIMO BC) and MIMO multiple-access channels (MIMO MAC) for downlink and uplink situations, respectively. Again in comparison, SU-MIMO may be represented as a point-to-point, pairwise MIMO.

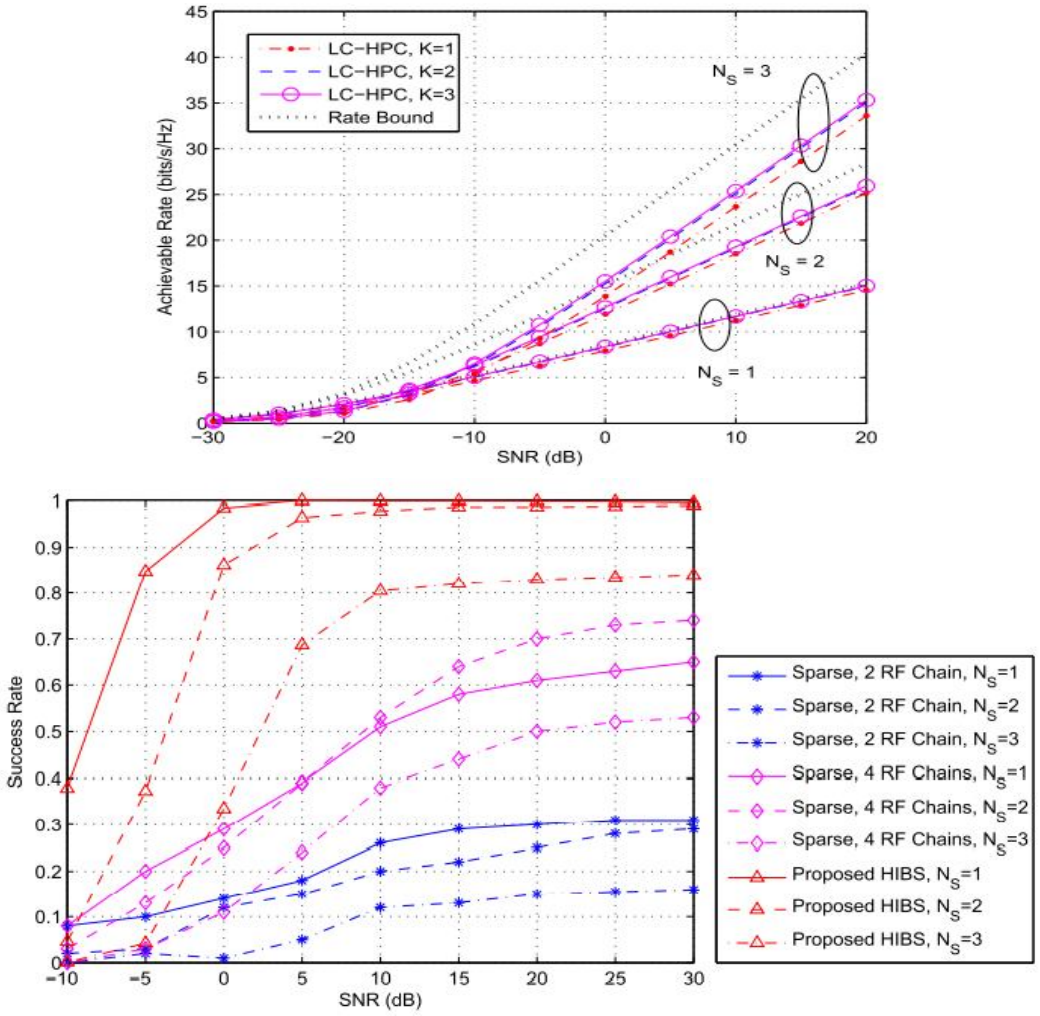
Massive Multiple-Input Multiple-Output (MIMO) is the most enthralling wireless access technology to deliver the needs of 5G and beyond networks. Massive MIMO is an extension of MIMO technology, which involves using hundreds and even thousands of antennas attached to a base station to improve spectral efficiency and throughput. This technology is about bringing

## II. PRECODING

One of the main concepts in massive MIMO systems is a precoding technology that transforms the complexity system from the side of received terminals to the side of BS by using a strong signal processing technology at the transmitter. Usually, in a real wireless propagation environment, it is difficult to obtain a reliable CSI where the performance of DL transmission largely depends on CSI. The precoding technology can be employed to deal with imperfect CSI. Many research papers have shown that massive MIMO precoding technology acts as a critical role to out from the bottleneck of breaking down the system's performance by controlling the direction of the beams and pointing them into a specific received terminal location. Utilization of the precoding technology in massive MIMO systems leads to eliminating/canceling the effects of interference and fading, and increasing the throughput and capacity when the number of antennas approaches infinity. The precoding algorithms can be mainly classified into linear, non-linear, PAPR precoding, and machine learning-based precoding algorithm.

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## III.RESULTS



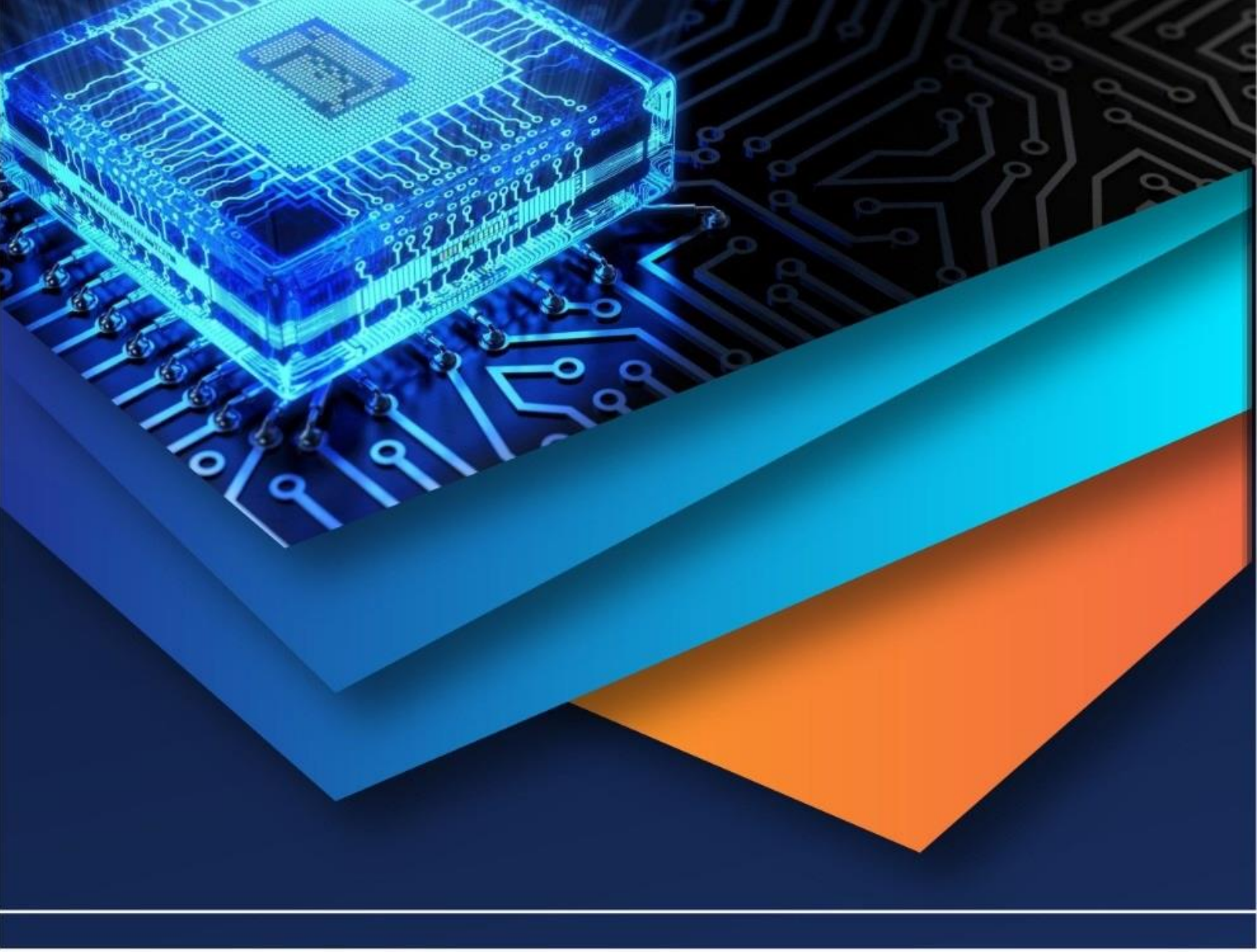

## IV CONCLUSION

Massive MIMO provides a great improvement in user experience and mobile services. It will stay a competitive candidate in the next decade. However, significant research dedicated to the transmitter's design is proposed. This paper has surveyed the linear and non-linear precoding schemes that pertain to massive MIMO systems. Although linear precoders suffer from performance deterioration under certain scenarios, they still play a crucial role in the transmitter design due to their relative simplicity. In this paper, a comparison between different linear precoders is provided. In addition, an in-depth discussion on non-linear precoders with their performance-complexity profile is presented. It is shown that the non-linear precoders have a high computational complexity but they are promising to obtain a satisfactory performance.

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