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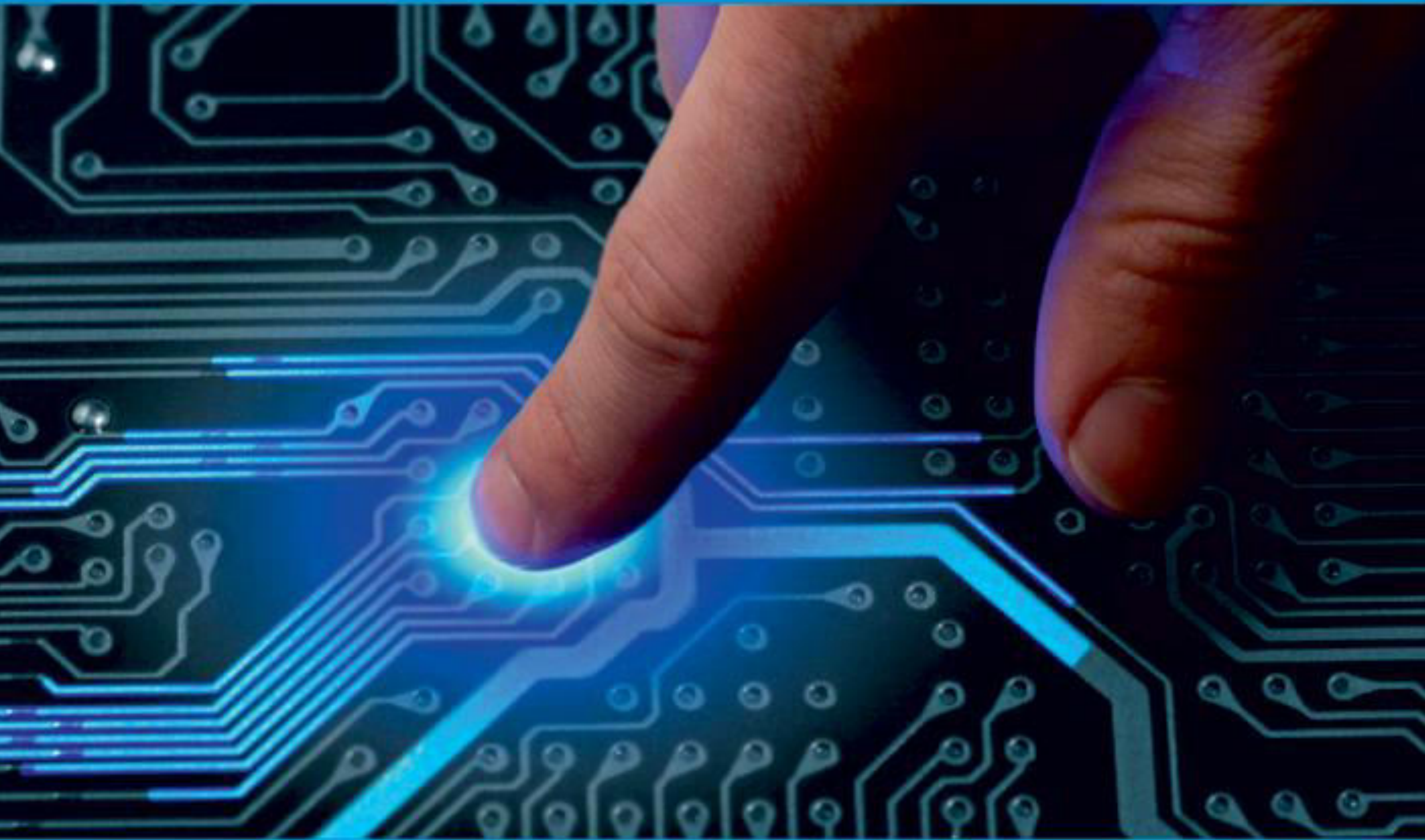

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Performance and Analysis of Channel Estimation in MIMO-OFDM System

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ABSTRACT: This contribution introduces a new transmission scheme for multiple-input multiple-output (MIMO) orthogonal frequency division multiplexing (OFDM) systems. The new scheme is efficient and suitable especially for symmetric channels such as the link between two base stations or between two antennas on radio beam transmission. The principle is based on the estimation of channel parameters of a pilot data send by the receiver to the transmitter. Then, the transmitter codes the transmitted signal using the estimated channel parameters to adapt the signal to the channel variations. Conducted Monte-Carlo simulation results show that the proposed scheme has better performance, in terms of bandwidth efficiency and complexity, compared to the conventional MIMO-OFDM scheme methods in the case of a symmetric channel.

I. INTRODUCTION

The next generation of wireless mobile communication systems requires the reliable transmission of high-rate data under various types of channels and scenarios. Current wireless mobile, data, and fixed access communication systems are converging into a data (all IP) oriented wireless networks with high spectral efficiency. Future wireless communication systems should be flexible and adaptive to various scenarios and Quality-of-Service (QoS) requirements. The system should be robust to the influence of fading, interference, and hardware imperfections.

The very high data rates that are required for future wireless systems in reasonably large areas do not appear to be feasible with the conventional techniques and architectures. Frequency bands that are envisioned for future wireless communication systems are well above 2 GHz. The radio propagation in these bands is significantly more vulnerable to non-line-of sight (NLOS)conditions, which is typical in modern urban communications.

The efficient design of wireless systems will require the use of multiple antennas, advanced adaptive modulation and coding schemes, relaying nodes, cooperative networks and users, and cross-layer design.

An important research topic is the study of multi-user (MU) MIMO systems. Such systems have the potential to combine the high capacity achievable with MIMO processing with the benefits of space division multiple access (SDMA). In the MU MIMO scenario, a base station (BS) or an access point (AP) is equipped with multiple antennas and it is simultaneously communicating with a group of users. Each of these users is also equipped with multiple antennas. Motivated by the need for cheap mobiles with low power consumption, we focus on systems where the complex signal processing is performed at the BS/AP. The BS/AP will use the CSI available at the transmitter to allow these users to share the same channel and mitigate or completely eliminate multi-user interference (MUI) in an ideal case.

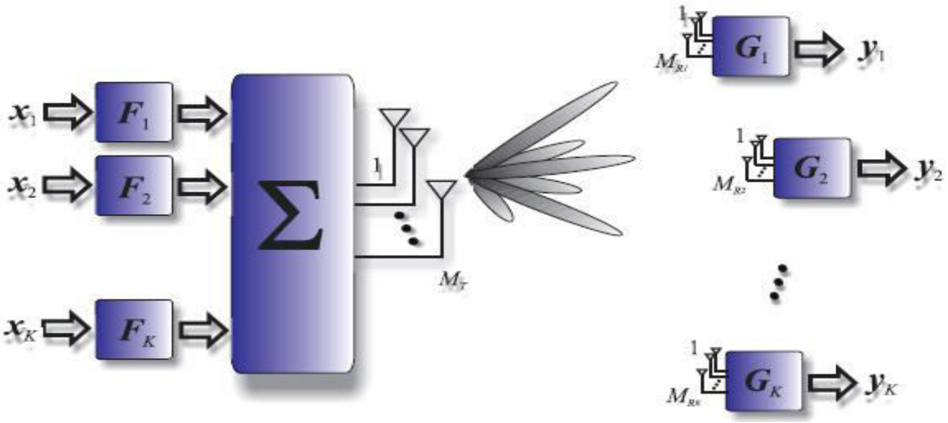

Figure 1: Block diagram of multi-user MIMO downlink system

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DPC is a technique that allows non-causally known interference to be "pre-subtracted" at the transmitter. In this it was shown that the achievable region of the MIMO BC obtained using DPC is equal to the capacity region of the MIMO MAC using uplink downlink duality. This allows us to substitute the non-convex problem of finding the DPC rate region with the dual MAC problem where the rates are convex functions of the correlation matrices.

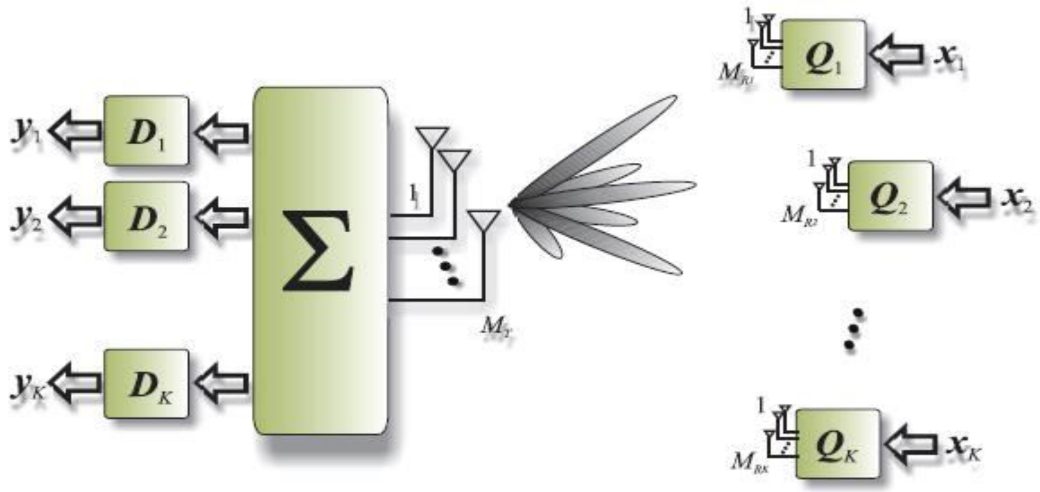

Figure 2: Block diagram of multi-user MIMO uplink system.

Predicting the emerging and future wire- Less Communications technologiesIn a little over two decades, the mobile phone has gone from being an expensive piece of hardware to a pervasive low cost technology enabling users to communicate regardless of their location. Other technologies such as Wi-Fi, which al- low users to deploy network connections without cabling, provide mobile access to services such as internet and gaming applications, and have become ubiq- uitous in modern personal communications devices. Future wireless systems will aim to deliver high data rates and quality of service (QoS) for both indoor and outdoor environments. In addition to extending the range of applications available on personal communications devices, it is expected that standards such as the fourth generation of mobile systems (4G) will integrate mobile communications specified by International Mobile Telecommunications (IMT) standards and Wireless Local Area Networks (WLAN) [1]. Such projections have motivated extensive studies on the achievable capacity gains associated with multi-user MIMO systems.

II. PROPOSED METHODOLOGY

The MIMO algorithms are narrowband algorithms. In order to deal with the frequency selective nature of wideband wireless channels, MIMO can be combined with OFDM. Effectively, OFDM transforms a frequency-selective channel into parallel flat-fading sub channels, i.e., the signals on the subcarriers undergo narrowband fading. In this way MIMO and OFDM are complement each other. Hence, by performing MIMO transmission and detection per subcarrier, MIMO algorithms can be applied in broad band communication.

III. MIMO-OFDM SYSTEM

The multiple inputs multiple output technology employs multiple transmit and receive antennas at either end of the wireless link to increase data rates or the reliability with which data is received. MIMO systems offer an efficient way of improving the performance of a wireless link through the exploitation of the spatial resource. MIMO equipped systems can also implement the discrete multitone technique OFDM which has the advantage of eliminating inter symbol interference, an effect prevalent at high data rates due to multiple path propagation. The MIMO-0OFDM technology is therefore poised to deliver the high data throughput and quality of service projected for future wireless systems.

Consider a MIMO OFDM system with Nt transmit (TX) and Nr receive (RX) antennas. In addition to the spatial and temporal dimension of MIMO, OFDM adds one extra dimension to exploit, namely, the frequency dimension. In general, the incoming bit stream is first encoded by a one-dimensional encoder after which the encoded bits are mapped

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onto the three available dimensions by the Space-Time-Frequency (STF) mapper. After the STF mapper, each TX branch consists of almost an entire OFDM transmitter.

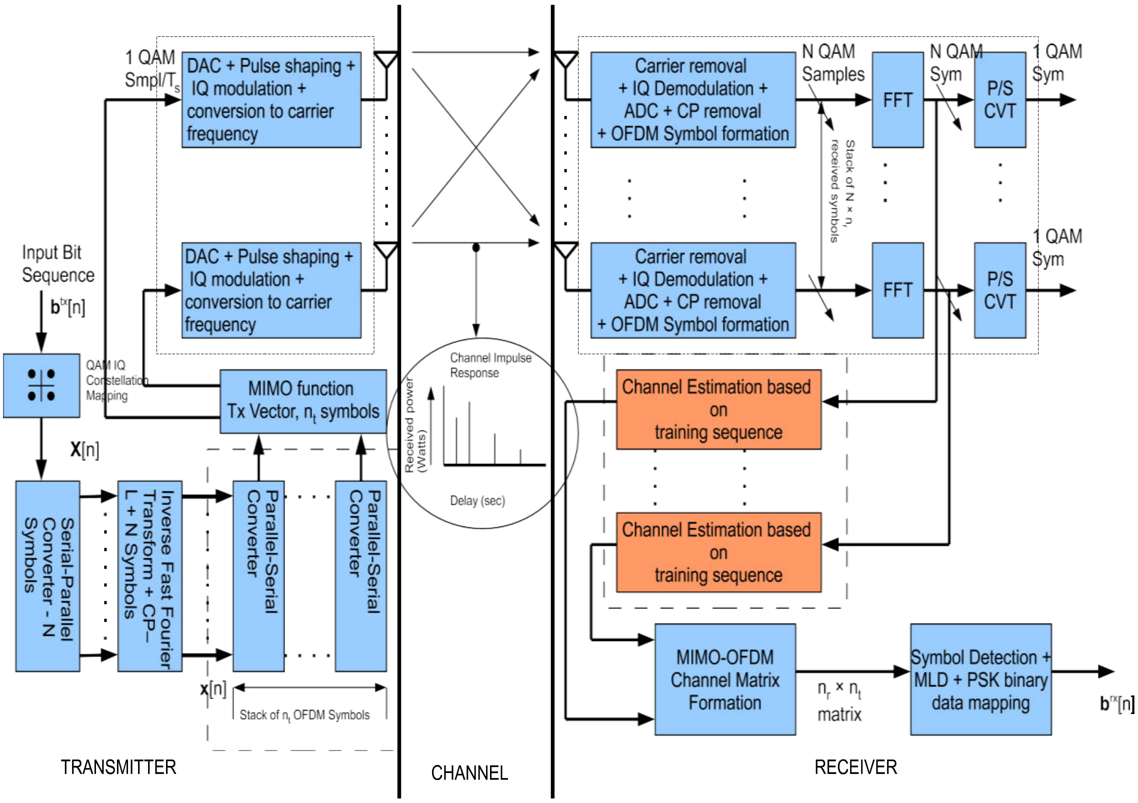

Figure 3: A generic MIMO-OFDM communications system

IV. PILOT CHANNEL ESTIMATION TECHNIQUES

Channel Estimation is the process of characterizing the effect of the physical medium on the input sequence. It is an important and necessary function for wireless systems. Even with a limited knowledge of the wireless channel properties, a receiver can gain insight into the data sent over by the transmitter.

The main goal of Channel Estimation is to measure the effects of the channel on know nor partially known set of transmissions. Orthogonal Frequency division multiplexing(OFDM) Systems are especially suited for channel estimation. The sub carriers are closely spaced. While the system is generally used in high speed applications that are capable of computing channel estimates with minimum delay.

SIGNAL OUTCOMES

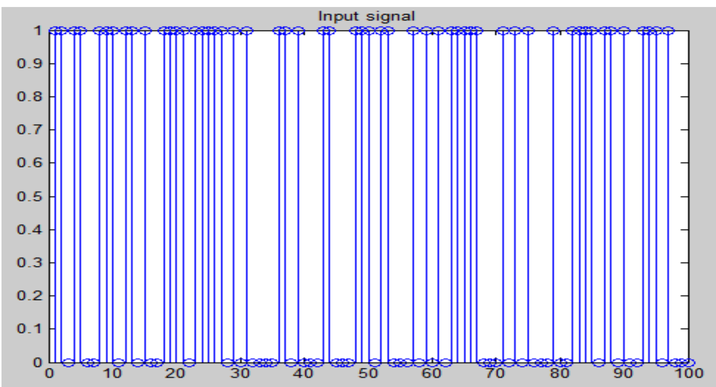

Figure 4.: Input signal used in MIMO-OFDM system

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Figure 4 represents the signal applied as an input for the MIMO-OFDM system of our proposed work. This is signal which is known as the message signal or information which is send to the receiving end.

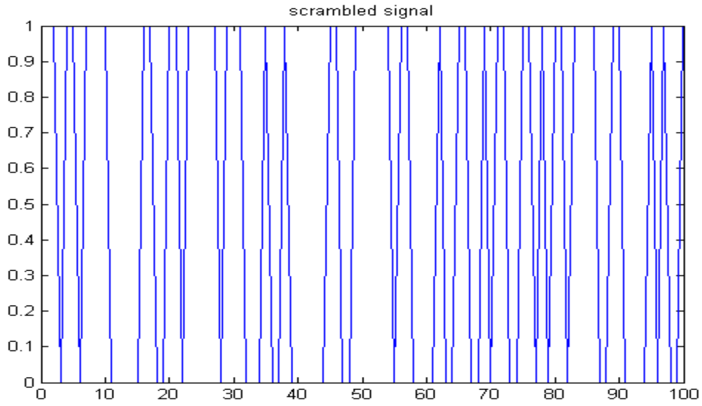

Figure 5 : Scrambled output signal after applied input

Figure 5 represents the scrambled output signal after applied input for the MIMO-OFDM system. Data scrambling is the process to remove sensitive data from the input signal.

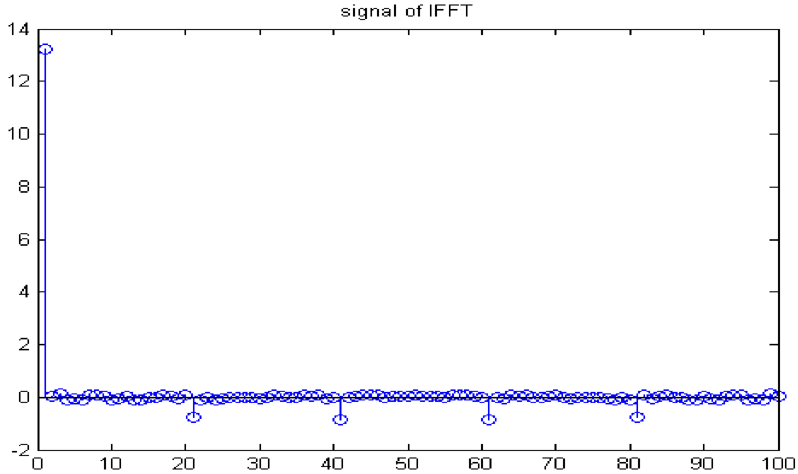

Figure 6: Signal is in the Inverse fast fourier transformed output

Figure 6 represents the Inverse fast Fourier transformed (IFFT) output of the signal. IFFT performs in the pilots inserted MIMO-OFDM symbols. IFFT is the very efficient algorithm to perform the QAM modulation in the MIMO-OFDM in the transmitter.

V. CONCLUSION

Wireless Communication Technology has developed many folds over the past few years. One of the techniques to enhance the data rates is called Multiple Input Multiple Output (MIMO) in which multiple antennas are employed both at the transmitter and the receiver. Multiple signals are transmitted from different antennas at the transmitter using the same frequency and separated in space. Multiple-input multiple-output orthogonal frequency division multiplexing (MIMO-OFDM) technology is one of the most attractive candidates for fourth generation (4G) mobile radio communication. It effectively combats the multipath fading channel and improves the bandwidth efficiency.

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