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Performance Improvement of Mimo-Mc-Cdma System Using Equalization, Beam forming and Relay

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Abstract- Globally the demand for wireless application is increasing every year which necessitates the design of progressive and perfect transmission of multimedia data over wireless multipath channels. Even though, MIMO MC CDMA is chosen as the access technique for realizing the same, quality offered by this technique fails to meet the demands of future wireless communication system. To improve the performance of the system, this work proposes the MPCE based MMSE equalization, ITBF and NR to meet the quality of wireless communication such as high transmission rate, more transmission range and transmission reliability.

Keywords- MIMO, OFDM, MIMO MC, CDMA SSTEM.

I.INTRODUCTION

Next generation wireless systems are predominantly based on multiple antenna and multi-carrier transmission technologies. In this context, MC-CDMA, which is a combination of orthogonal frequency division multiplexing (OFDM) and CDMA has garnered a significant research interest. MCCDMA exploits the advantages of OFDM which converts the frequency-selective wireless channel into multiple parallel narrowband flat-fading channels and CDMA, which combats wireless channel fading through multi-path diversity combining.

Further, multiple-input multiple-output (MIMO) technology can be employed in MC-CDMA systems to increase the sum-rates by spatially multiplexing several users. Due to the current bandwidth scarcity, it is essential to improve the spectral efficiency of the system by intelligently utilizing the available time-frequency resources to schedule a large number of users.

However, in MC-CDMA systems, as the number of users increases, the sum-rate saturates due to strong interference from the undesired users [1]. Therefore it is necessary to design interference Management algorithms towards scheduling a larger number of users in a given time frequency resource thereby increasing the spectral and energy efficiency. In this context, multi-user MIMO beam forming has shown significant potential in increasing the sum-rates through intelligent interference management. However, there is a dearth of research in developing beam forming techniques tailored for frequency selective MIMO MC-CDMA systems.

II. PERFORMANCE OF MIMO MC CDMA SSTEM WITH MPCE BASED MMSE EUALIATION AND ITBF

BF techniques are designed to transmit or receive the signal to/from the preferred direction, where multiple antennas are used to shape the overall antenna beam in a certain way to maximize antenna gain in target direction and to suppress target dominant interference. The main goal of BF is to increase received SNR and subsequently to improve coverage. The useful signal in a targeted direction is enhanced by constructive combination, whereas noise or interference are rejected by destructive combination.

1. TYPES OF BEAMFORMING

Beam forming can be classified as fixed beam forming, switched beam forming, delay and sum beam forming, beam space beam forming and adaptive beam forming

2. Fixed Beam forming

In fixed BF the interference is not completely suppressed and also it does not perform amplitude weighting of the received signal which can be realized by adopting either an analog approach (e.g. switched beam, delay and sum) or a digital approach (e.g. beam space BF) where the system can be usually realized at a reasonable cost.

3. Adaptive Beam forming

Adaptive Antennas are also referred to as smart antenna systems and represents advanced techniques able to maximize the SINR at the array output. They find application in environments where the spatial correlation between the signal replicas is high. The radiation pattern is dynamically controlled to perform the electrical beam steering to a desired direction, and null steering to reject interfering signals.

In mobile radio environment, the users keep moving and hence they are time varying. Also the parameters of the user signals vary in time due to the presence of multipath, co channel interference and noise associated with the channel. Fixed weights will not track these changes in the time varying channel. An adaptive antenna array can change its beam pattern in response to the changing signals.

This kind of antenna system usually works with some internal feedback whereby the system can modify the antenna patterns. The weights used must be changed using adaptive algorithms. Such algorithms are usually design like MSE, ML, Maximum SNR and Maximum SINR, generating a set of equations. These performance criteria are usually expressed as cost functions and the weights are adapted iteratively until the cost function converges to a minimum value.

III.RESULT

The MIMO MC CDMA system with MPCE based MMSE equalization and ITBF is simulated for different diversity techniques using MATLAB with the parameters.

1. Performance of the System with MPCE Based MMSE and ITBF PS

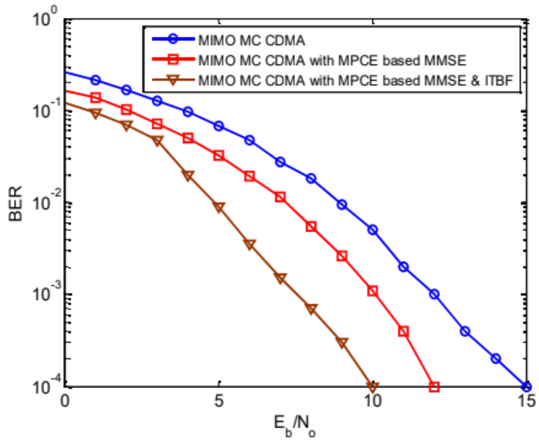

Fig.1 Performance of 4 x 4 antennas configuration (128 SCs, QPSK)

2. Performance of the system with MPCE based MMSE and ITBF(16 QAM)

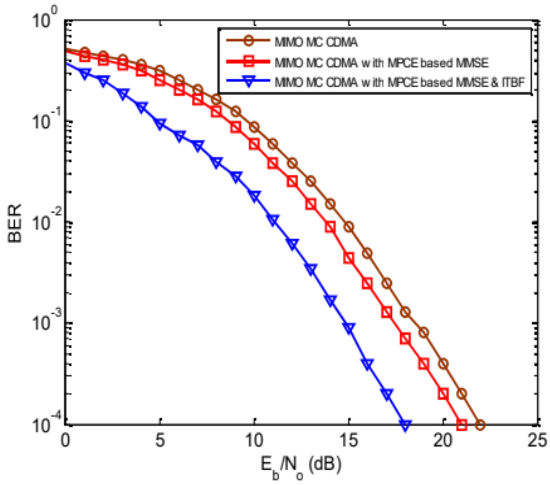

Fig.2 Performance of 2 x 2 antennas configuration (16 SCs, 16 QAM)

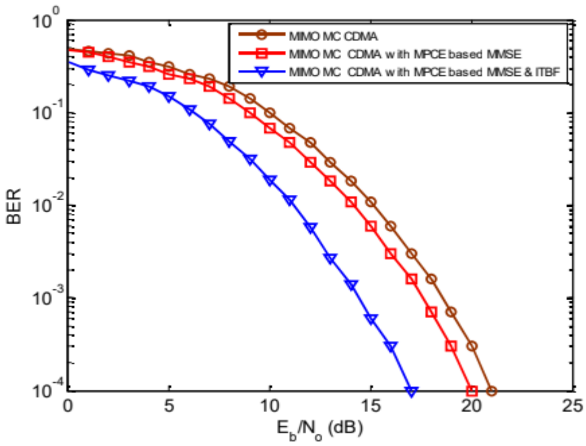

Fig.3 Performance of 2 x 2 antennas configuration (64 SCs, 16 QAM)

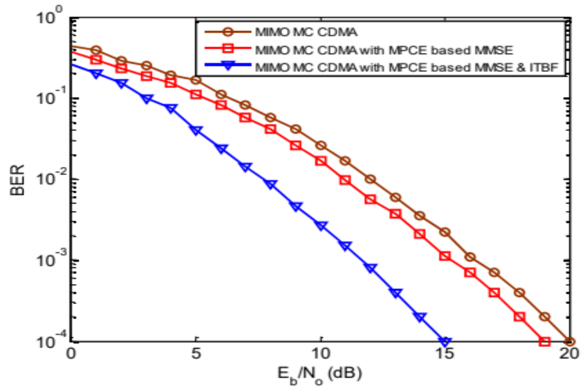

Fig.4 Performance of 2 x 2 antennas configuration (128 SCs, 16 QAM)

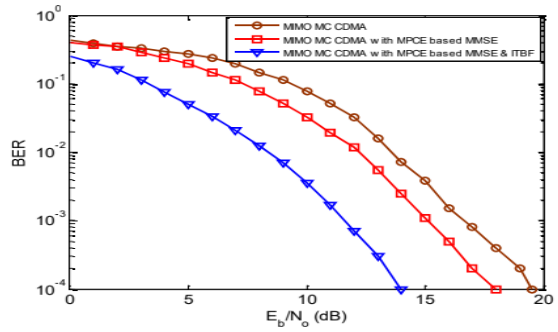

Fig.5 Performance of 4 x 4 antennas configuration (16 SCs, 16 QAM)

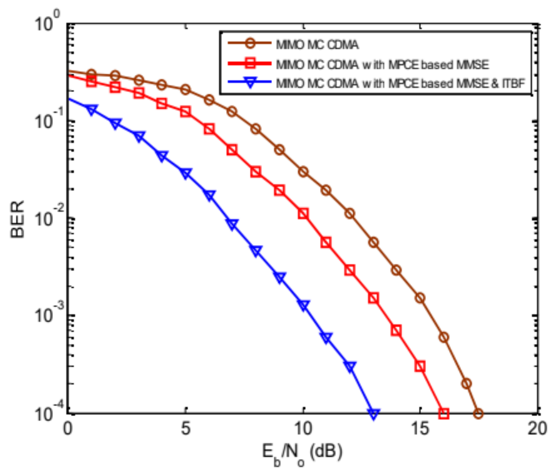

Fig.6 Performance of 4 x 4 antennas configuration (64 SCs, 16 QAM)

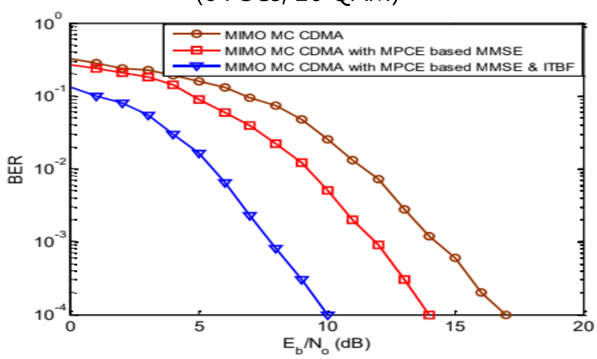

Fig.7 Performance of 4 x 4 antennas configuration (128 SCs, 16 QAM).

ITBF is incorporated in MIMO MC CDMA to effectively tackle the channel impairments. ITBF is made dynamic to suit the nature of fast fading channel and from the simulation result it is observed system with ITBF and MPCE based equalization is better than the system with MPCE based equalizer alone. From the numerical result it is observed that the performance of the system increases due to the diversity offered by ITBF in the range of 17.58% to 21.22% for 2x2 antennas and 22% to 35% for 4x4 antenna configuration.

IV.CONCLUSION

The communication over wireless channel has three fundamental distinctions from the wire line communication. The first is the large-scale and small scale fading, second is the interference between the transmitter and receiver and the third is the user mobility in the network. The presence of fading, interference and mobility makes the design of wireless communication system challenging.

The conventional design focusing on the reliability of the connection needs to mitigate the fading and multipath effects. Modern wireless system design focusing on the spectral efficiency gains from the rich multipath environment by means of utilizing bandwidth and spatial diversity through multicarrier modulation and MIMO communication. However, possible potential gain in spectral efficiency is challenged by the receiver's ability to accurately detect the symbol. A beam forming method is proposed which helps to improve the receiver performance without degrading any benefit of a MIMO MC CDMA. To further increase the throughput and extend the coverage of cellular networks the relay networks can be incorporated in the MIMOMC CDMA system.

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