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Performance Enhancement Through Multiple Antenna Space–Time Block Code And Site Diversity Technique For MC- CDMA System

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ABSTRACT: The combination of multiple antennas and multicarrier code division multiple accesses (MC-CDMA) is a strong candidate for the downlink of future mobile communications. The paper of such systems in scenarios that model real life transmissions is an additional step towards an optimized achievement. Nevertheless, when transmitting over fading channel multi-cell interference occurs and this degrades the performance of the system. Site diversity technique is applied to the system to overcome multi-cell interference. Due to non orthogonal of spreading codes, multi-cell interference is not completely eradicated.

Index Terms: multicarrier code division multiple accesses**,** multiple input multiple output, site diversity,

I. INTRODUCTION

Multiple-antenna technology is a rich area of research. Whether for future military wireless networks, soldier radios, autonomous sensors, or robotics, the demand for improved performance may be met with multiple-antenna communication links and the advanced technology making those links effective. Lincoln Laboratory is investigating multiple-input multiple-output (MIMO) techniques to improve the robustness and performance of wireless links. Here, the term multiple-input multiple-output refers to the use of an array of antennas for both transmitting and receiving. MIMO approaches show promise of enabling better wireless communications because they mitigate problems inherent in ground-to-ground links, which are the most common links used by wireless devices, including cell phones and WiFi. Typically, ground-to-ground links are not line of sight. The electromagnetic waves transmitted from the antennas bounce around the environment in a complicated fashion and end up at the receiver coming from multiple directions and with varying delays. To overcome this problem, spreading codes are assigned to each base station. Space time trellis code (STTC) site diversity with multiple input multiple output (MIMO) technique was introduced to reduce multi-cell interference further. STTC based space time block code (STBC) site diversity technique is proposed to improve the performance of MC-CDMA system. Simulation result shows that STTC based STBC site diversity outperforms STTC site diversity.

MC-CDMA is a promising wireless access method for wideband downlink transmission due to its robustness against the frequency-selectivity of a multipath channel and its high-frequency efficiency. However, in the conventional MC-CDMA system, like other CDMA schemes, the user's multiplexing capability is limited to the length of the spreading code. Furthermore, as the number of users to be multiplexed increases, the performance is degraded due to increasing inter-code interference before starting site diversity communication, each measures the local average received power of its surrounding which can be estimated by using pilot symbols transmitted periodically from each signal. The selects the transmuting that has the largest local average power as the site diversity partner of the current associated, we assume ideal power estimation, which means that the average received power from surrounding signal is exactly estimated at the maximum signal . The signal reports the selected site diversity partner receiver to the radio network controller (RNC) via uplink, the RNC assigns scrambling codes to the site diversity participant base signal in some specific pattern STBC is a technique used in wireless communications to transmit multiple copies of data stream across a number of antennas and is also employed to exploit the various received versions of the data in order to improve the reliability of data-transfer If the transmitter does not know the CSI, it is necessary to code across both space and time in order to obtain transmit diversity which can significantly reduce the complexity of the system.

Broadband wireless access for evolving mobile internet and multimedia services are driving a surge of research on future wireless communication systems to support multi-user access and high data rates. Multi-carrier code division multiple access (MC-CDMA), which suits high data rate applications with multiplexing technique appears to be a promising technique in achieving high data rates [1]. MC-CDMA is robust to multi-path fading, inheriting the advantages of conventional CDMA where frequency diversity can be achieved in a broadband channel [2]. With its capability of synchronous transmission, MC-CDMA is suitable for downlink of cellular communication systems [3]. The challenge of achieving reliable data transmission over wireless link is more difficult due to the fact that received signals from multi-paths add destructively causing multi-cell interference which results in serious performance degradation. To achieve reliable communication over wireless links antenna diversity [4] derived by employing spatially separated antennas at the transmitter and receiver was introduced. High data rate MC-CDMA systems additionally employs multiple input multiple output (MIMO) techniques to mitigate fading [5]. Data transmission involves spreading operations by the use of short channelisation code and long scrambling code. Short channelisation code helps in separating the signals of different users present within the cell and long scrambling code mitigates the effects of interference produced by users belonging to other cells. However, the system faces multi-cell interference due to fading channel resulting in degradation of bit-error rate (BER). Site diversity technique has been proposed for realizing CDMA and orthogonal frequency division multiplexing (OFDM) systems to minimize multi-cell interference [5-7], where space time block code (STBC) is used to gain diversity effect among several base stations. STBC site diversity system transmits the encoded signals from several base stations and these signals are combined at the receiver with STBC decoding operation. STBC branches and the scrambling codes are assigned to each base station to maintain orthogonality of signals between the cells and to reduce interference among them. The same technique is extended to MC-CDMA system. However, the scrambling codes assigned are generally non orthogonal among cells and hence multi-cell interference still exists. Using STBC with multiple antennas at each base station, site diversity was achieved with further reduction in multi-cell interference [8]. STBC does not provide coding gain and in view of this it is worthwhile to consider a joint design of error control coding, modulation, transmit and receive diversity to develop an effective signalling scheme called space time trellis code (STTC) [9], which combats the effects of fading. STTC became extremely popular as it can simultaneously offer coding gain with spectral efficiency and full diversity over fading channels. STTC was used to obtain site diversity with multiple antennas at base station and it outperformed STBC based site diversity in terms of error rates [10]. A new class of 4- phase shift keying (4-PSK) STTC using points of constellation with same probability called as balanced STTC (B-STTC) [11] was proposed for multiple transmit antennas. STBC based STTC codes built with set partitioning introduced in [12], achieves more diversity gain and achieves better performance in terms of error rates. In this work B-STTC with multiple antennas at base station is used to obtain site diversity for MC-CDMA system.

The space-time decoder needs to know the path gains, also called channel state information (CSI), to decode the transmitted codeword. The received signal is weighted by the path gains and the Euclidean distance is used as the input to the maximum likelihood vector detector for decoding process. in the matrix at the left of the trellis and are grouped together for different transmit antennas. Symbol bits are fed as input to the upper and lower branches. The branch coefficients are arranged alternatively in the generator matrix.

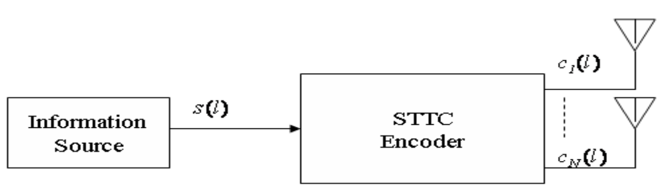


Fig. 1. Block diagram of STTC transmitter.

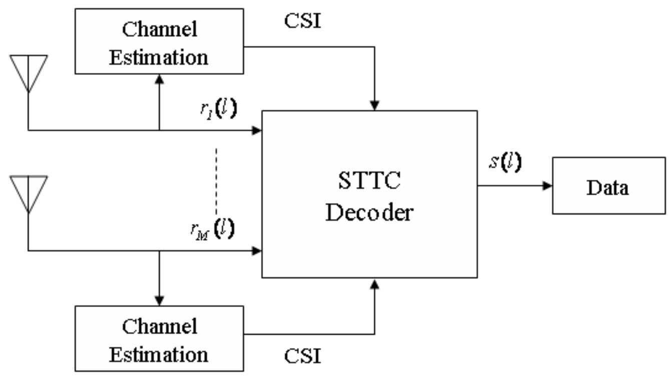


Fig. 2. Block diagram of STTC receiver.

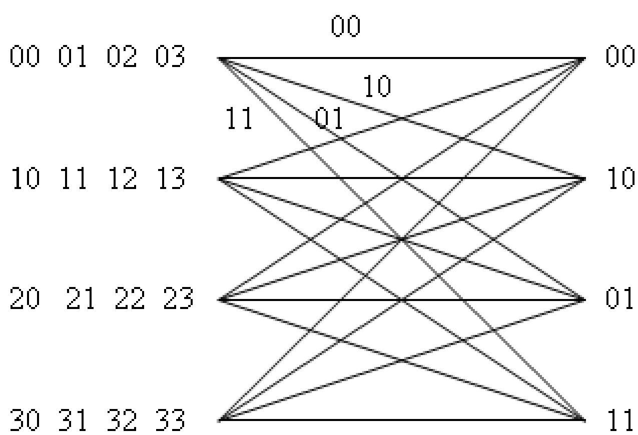
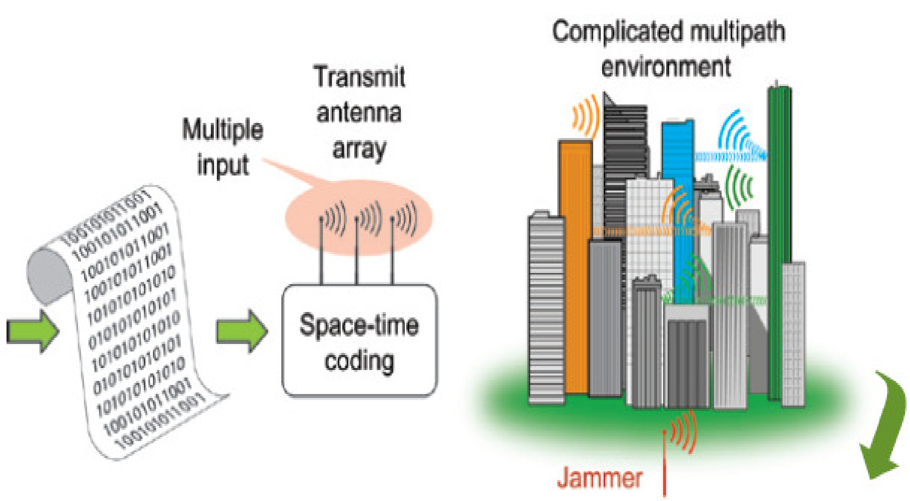


Fig. 3. Trellis diagram for STTC.



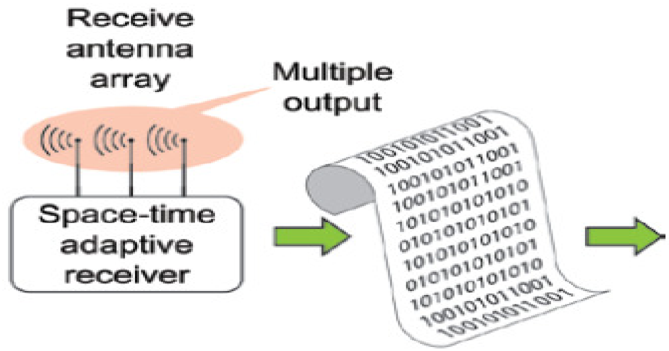


Fig. 4. MIMO communication links enable accurate data to be received despite a complicated multipath environment with jamming.

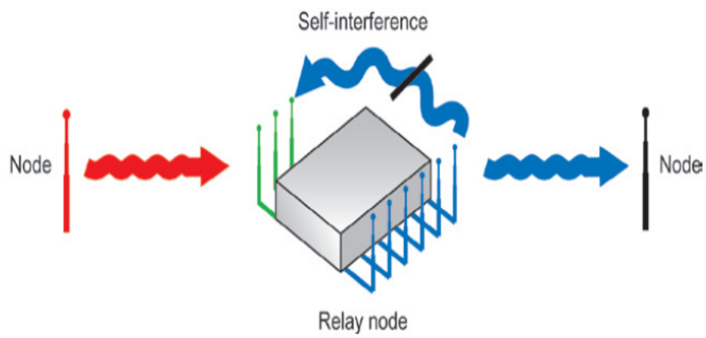


Fig. 5. A full-duplex relay employing self-interference mitigation may provide the ability to build full-duplex nodes that simultaneously transmit and receive at thesame frequency.

RESULT

The proposed noise reduction in balanced STTC for OFDM is simulated by using MATLAB 7.8.0. MATLAB is a strong mathematical tool which provides help to engineers to solve, model, simulate the problems and find solutions assuming environment in to mathematical equations. It is standard engineering tool as it perform many different tasks using different tool box relevant to different particular cases e.g. Control systems, signal processing, image processing, communication systems, and support complex matrix manipulation, simulink etc. In different research field it provides platform for learning and comparison of theoretical hypothesis and simulated values (Table 1).

Table 1: Various simulation parameters.

Modulation scheme	QPSK
Number of sub carrier for OFDM	128
Symbol length	64 bit
Channel estimation	Perfect estimation
Signal estimation	Correlated
Channel	Fast Rayleigh fading channel with AWGN floor
Scrambling code	Random code of length 63

It even provides support to nonlinear system calculations and result. This chapter presents performance of the Optimized STBC Site Diversity Technique for MC-CDMA System developed in MATLAB. A new closed-loop transmit diversity scheme for Optimized STBC Site Diversity Technique for MC- CDMA System diversity systems based on space-time block coding (STBC). The receiver of the scheme checks the output signal-to-noise ratio (SNR) of the space-time decoder against an output threshold and requests the transmitter to replace the transmit antenna.

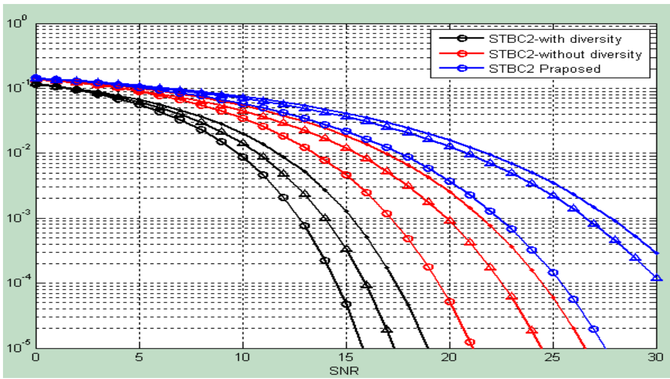


Fig. 6.

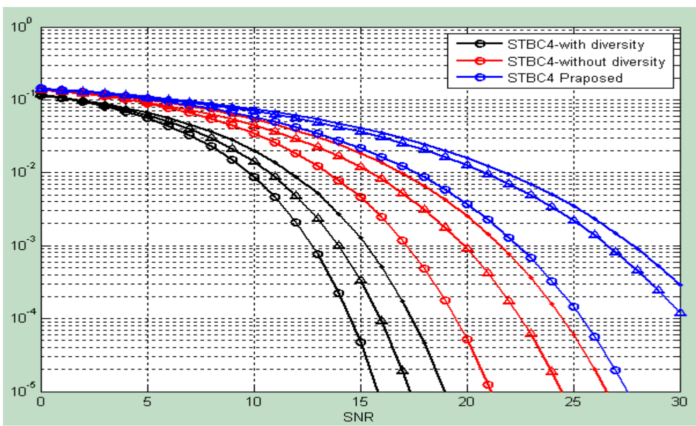


Fig. 7.

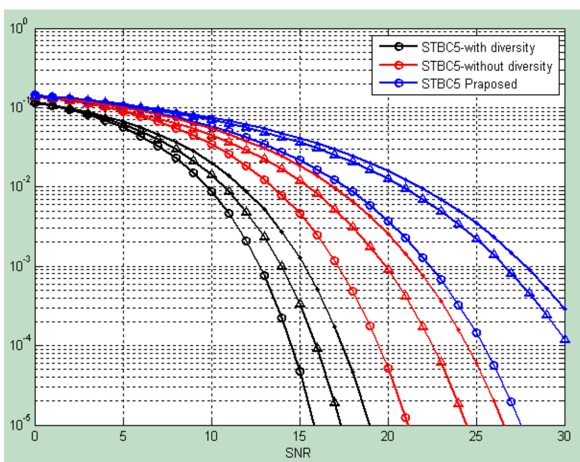


Fig. 8.

CONCLUSION

A novel receiver scheme has been investigated for MC-CDMA systems using Alamouti's space-time block coding. In particular, we considered a Minimum Conditional Bit-Error-Rate (MCBER) MUD linear receiver in order to reduce the computational complexity without significant performance degradations with respect to the formal MBER criterion. In the perspective of a real receiver deployment, an adaptive LMS-based implementation of the MCBER detector has been integrated with a robust and computationally affordable channel estimation assisted by a genetic optimizer. The proposed MCBER approach always allows improving BER performances with respect to other state-of-the-art linear detectors working with the same degree of channel knowledge. It is worth noting that the performance improvement with respect to MMSE-MUD strategies is achieved by spending a reduced computational effort, linearly increasing with the number of users. Numerical results evidenced that BER curves of MCBER and ideal MMSE are getting closer as the number of users approaches the maximum allowable value. This behavior is intrinsic to the linear multiuser detection and fully motivated by the nature of the MCBER criterion adopted. Activities might concern the utilization of evolutionary optimization algorithms (e.g., GA, Particle Swarm Optimization (PSO), etc.) to provide a numerical solution to the MCBER problem instead of the proposed LMS-based solution. Also the adoption of PSO-assisted channel estimation, instead of GA-assisted one, may represent an interesting topic for future research STBC Space Time Block Coding is a technique that is used within wireless communication networks for the purpose of transmitting multiple copies of one data stream across many antennas, so that the different received versions of that data can be utilized to help improve the data-transfer reliability rating In MC-CDMA systems, each data undergoes a different channel condition and arrives with a different error rate at the base station.By transmitting message data based on the Channel State Information (CSI), a new data transmission scheme called Adaptive Multi-Carrier CDMA a higher system capacity than a conventional MC-CDMA at various noise scenarios STTC with two-transmit antennas. The trellis diagram is similar to those used in the trellis coded modulation (TCM). State bits are shown at the right of the trellis; each line represents a possible transition with the input bits shown besides the line. Current state outputs and inputs are shown in the matrix at the left of the trellis and are grouped together for different transmit antennas. Symbol bits are fed as input to the upper and lower branches. The branch coefficients are arrang**ed alternatively in the generator**

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