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STTC for OFDM Using MIMO Compatible with 4G High Data Rate Wireless Systems

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Abstract: - *The wireless channel suffers from attenuation due to destructive multipath in the propagation media. These forms of attenuation result in the inefficient and unreliable transmission of data over many radio channels. Some possible, but non-pragmatic, solutions to combat this degradation are to increase transmission power, antenna size, or antenna height. A realistic alternative to these solutions would be to transmit some less-attenuated replica of the signal to the receiver thereby increasing the probability that the receiver will receive a less corrupted signal. This scheme of transmission and reception is called diversity and it is the most important technique used to encounter the effects of fading in wireless communications.*

Keywords: STTC, MIMO, OFDM, QPSK, Bit error rate, probability of error.

INTRODUCTION

In the past, communication systems like telephony and telegraphy, etc, were all analog and use electrical wires. They are hence the examples of wired communication system. With further development, the focus shifted towards the digitization of the communication system. A breakthrough in this field was with the advent of wireless technology due to the invention of the radio system.

Fading

The propagation of the signal through the wireless channel suffers from multipath fading that prevents the maximum use of available bands of the frequency spectrum. This multipath fading mainly occurs due to the reflection, diffraction, scattering, shadowing and from surrounding buildings and structures through which the wireless signal transmission takes place. Out of these, the multipath fading due to shadowing is considered as the long-scale fading while the others mentioned above are small-scale fading. The result of multipath fading is the severe loss in the quantity and quality of the transmitted signal that contains useful information. Due to these different fading reasons, the original information contained transmitted signal gets attenuated, as a result, the change in signal parameters is obtained. And received signal faces the random amplitude and phases moreover the signal strength will also be random. Therefore it is necessary to determine the overall path loss of the signal transmitted through a faded channel. The Accurate channel model is a valuable tool for the wireless fading channel characterization. The traditional simplest channel model is the Additive White Gaussian Noise (AWGN) model in which received signal is assumed to be affected only by constant attenuation and delay.

Multiple Input Multiple Output (MIMO) System

The need for high data rate and high spectral efficiency are the key elements for future wireless communication systems. Adaptive coding and modulation, iterative (turbo) decoding algorithms, space-time coding (STC), multiple antennas and multiple-input–multiple-output (MIMO) systems, multicarrier modulation (OFDM), and ultra-wideband radio are examples of enabling technologies for next-generation wireless communication. A particularly promising candidate for next-generation fixed and mobile wireless systems is the combination of multiple-input multiple-output (MIMO) technology with orthogonal frequency division multiplexing (OFDM) and with space-time coding (STC), known as MIMO-OFDM schemes, MIMO orthogonal frequency division multiplexing (MIMO–OFDM) and modulation is a promising candidate for future wireless systems. A MIMO system boosts spectral efficiency by using multiple antennas to simultaneously transmit data to the receiver. MIMO employs multiple antennas at the transmitter and multiple antennas at the receiver. The three basic link performances that completely describe the quality and usefulness of any wireless links are speed, coverage, reliability, which are improved by the use of multiple antennas at both transmitter and receiver, (MIMO) along with multicarrier system (OFDM) without any using additional frequency spectrum. The combination of a multi-antenna system with a multicarrier system gives excellent performances in multipath fading conditions.

2. PROBLEM FORMULATION

In this paper, we work in the area of wireless communication. MAC layer is a basic building block of wireless communication. In the MAC layer we perform modulation-demodulation and noise reduction of information code. This utility layer or coding technique suffers from several problems:

- Due to an increased number of transmitter and receiver, STTC suffer from High error rate.
- In traditional STTC coding technique, the available frequency spectrum is not efficiently used.
- The large size of information generates moderate corruption of bits.
- The provided OFDM technique does not get the optimal gain from Bandwidth.
- Due to different geographical conditions, Multipath fading occurs.
- Power efficiency is a cause of concern.
- To improve the Low carrier-to-co channel interference power ratio for better SER / BER.
- Improving sensitivity to multipath fading.
- Constant or near-constant envelope for information for secured and reliable communication at high data rates.

METHOD OF IMPLEMENTATION

In this paper, we perform the minimization of symbol error rate (SER) on the consideration of signal to noise ratio (SNR) with the multiple sets of STTC. We evaluate the performance of STTC in two different modes i.e. AWGN (Additive white Gaussian noise) and ZF (Zero forcing). In AWGN the bit error rate generally increases so in this dissertation we minimize the AWGN noise with transmitted code. We minimize the load variance of space time code in respect of channel gain. The capacity of the wireless communication system is determined by the modulation technique, efficiency on a single physical channel in terms of no bit per second per hertz. The perfect modulation scheme leads to higher bandwidth efficiency, low channel interference, near-constant envelope. After considering all aspects we are using PSK modulation with STTC codes as STTC provides good recovery with less error rate.

Table1 various simulation parameters

Modulation scheme	2-PSK, 4-PSK, 8-PSK, 16-PSK
Number of subcarriers for OFDM	124
Symbol length	64
Channel estimation	Perfect
Signal estimation	Correlated
Channel	Fast Rayleigh fading channel with AWGN floor
Decoding techniques	MMSE, ZF, Soft decision ML

RESULT ANALYSIS

The proposed noise reduction in balanced STTC for OFDM is simulated by using MATLAB is a strong mathematical tool that provides help to engineers to solve, model, simulate the problems and find solutions assuming environment into mathematical equations.

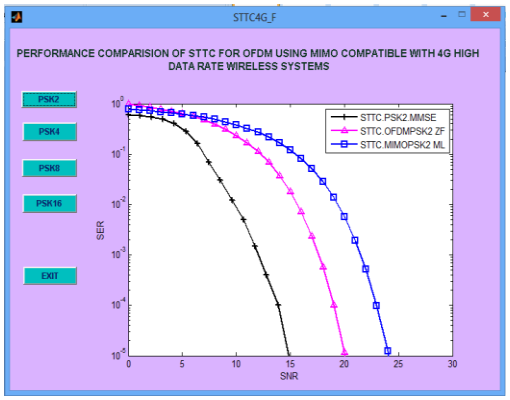

Figure 1 The relation of symbol error rate (SER) and SNR gain with 2- state PSK and conditions taken for decoding are MMSE and ZF and reduction of noise in transmission state.

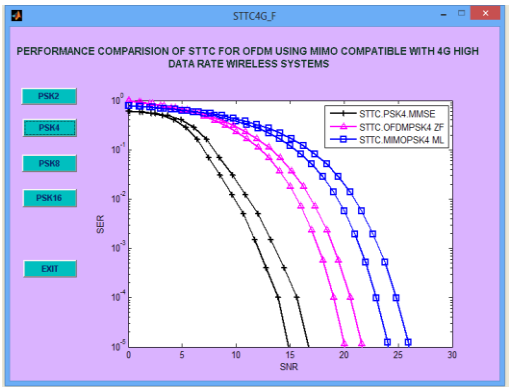

Figure 2 the relation of symbol error rate (SER) and SNR gain with 4- state PSK and conditions taken for decoding are MMSE and ZF and reduction of noise in transmission state.

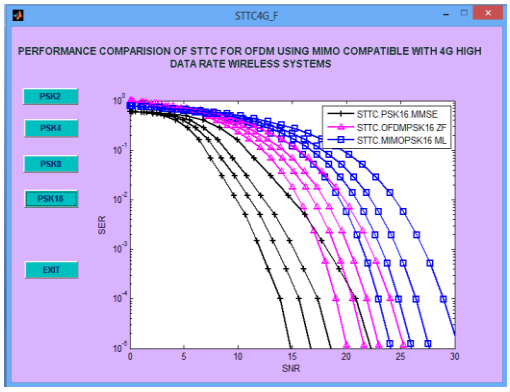

Figure 3 the relation of symbol error (SER) rate and SNR gain with 16- state PSK and conditions taken for decoding are MMSE and ZF and reduction of noise in transmission state.

It is a standard engineering tool as it performs many different tasks using different toolbox 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 a platform for

learning and comparison of theoretical hypothesis and simulated values. It even provides support to nonlinear system calculations and results.

CONCLUSION

In this paper, we propose a noise interference reduction technique for the improvement of high data rate in traditional space-time coding technique (STTC). We proposed a new technique of 2-PSK, 4-PSK, 16-PSK Balanced STTC for multiple transmit antennas. These codes generate the points of the constellation with the same probability. Therefore, the systematic search for good codes can be reduced to this class. A method to design the balanced codes has been described here. Finally, the performance of all these 2-state, 4-state and 16-state codes is evaluated by simulation and described by the Symbol Error Rate (SER) over fast Rayleigh fading channels with AWGN floor. Reduced noise-based estimation schemes are widely favored as their implementation is relatively simple and most current wireless standards already provide for their use. Training sequences for multiple transmit antennas require properties of zero (or very low) cross-correlation between sequences transmitted from different transmit antennas.

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