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Performance enhancement of MIMO OFDM using FEC codes

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ABSTRACT

In wireless communication, the transmitted messages are added with noise. The presence of noise and signal fading develop error messages in the channels. To overcome this problem one has to use forward error-correcting codes (FEC). FEC codes add the redundant bits at the transmitter side such that it can detect the error and correct error present in the channel medium. In this paper, we applied two codes; they are convolution codes and Turbo codes. In this paper, we use the MIMO-OFDM system that is the concatenation of both the "Multiple Input Multiple Output" (MIMO) systems and the Orthogonal Frequency Division Multiplexing (OFDM) system. To reduce interference and Increase the data rate OFDM system is used. To improve the performance of the OFDM system we use multiple antennas at a transmitter and a receiver side (MIMO) for reliable transmission. The forward error correction plays an important role in enhancing the performance of the MIMO-OFDM systems. The performance of a MIMO-OFDM system with the Convolutional and Turbo codes is evaluated based on Bit Error Rate (BER). In this paper Binary Phase Shift Keying (BPSK) modulation is applied and transmitted over Rayleigh channel. BER performance is obtained using MATLAB 19b. By comparing both coding techniques, it is determined that the Turbo code outperforms Convolutional code.

1. Introduction

In wireless communication, the Orthogonal Frequency Division Multiplexing system (OFDM) [1],which is also known as the multi-carrier modulation technique is used for better performance compared to Frequency division multiplexing(FDM). For modulation purpose multiple carriers are used. In the OFDM system [1,12], bandwidth is divided into the number of narrowband sub-channels that are orthogonal to each other. In this approach, each carrier is modulated by the low data rate of transmission bandwidth. This is the best technique for transmission of the high data. This technique can mitigate the effect of inter-symbol interference and inter-carrier interference [3]. Wireless communication MIMO system consists of multiple antennas that are present at the transmitter side and receiver side [4]. MIMO system is used for reliability and to improve the performance of the system [5]. The main concept of the MIMO system is that the antennas at the transmitter side and at the receiver side [14], that are connected in a manner to improve the quality and performance of the system i.e., BER or data rate. MIMO channels are used in several ways with different transmission schemes such as beam forming, space–time coding, or spatial multiplexing [13]. In wireless communication MIMO system is used to improve channel throughput and channel robustness. To improve the performance of the system [4] and to enhance spectral efficiency and link security, innovative technologies have been introduced [7] such as MIMO and OFDM in wireless communication systems [2,6].

For getting reliable information through the channel, a channel coding approach is used. In this approach, Extra bits are added at the transmitter; to perform two important goals at the receiver side, such as error detection and error correction. It can minimize the noise effect and the interferences on the receiver side. Channel coding [3] is designed to enhance the communication performance so that transmitting signal resist the channel impairments like jamming and noise fading.

The main aim of channel coding is to enhance the BER performance of band limited channels by adding extra bits to the information data at the transmitter. Forward error correcting codes

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