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Sensor's Data Transmission over QAM Using LDPC Over MIMO Channel to enhance the Channel capacity: Performance analysis over RMSE and BER

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Abstract. Modern communications systems utilize effective encoding plans, multiple-input multiple-output (MIMO) and high-order QAM-constellations for improves spectral efficiency. However, as the dimensions of the system grow, the design of efficient and low-complexity MIMO receivers possesses technical difficulties. Here in this paper, we have demonstrated data reduction method using Principal Component Analysis (PCA) to fuse the data at sensor level at the transmitter and regress the same at the receiver for improvising the channel capacity of the system. We have fused 45 signals sensor data having a bandwidth from 100Hz - 3000Hz which is sampled at 6000 Hz each. The regression is measured using the RMSE of the transmitted and received signals. Also, the communication system has demonstrated the performance of the 2,4,8QAM modulation technique with and without LDPC decoder(log-domain) for 2x2,3x3,4x4 Multiple Input Multiple Output(MIMO) channel for Bit Error Rate (BER). The performance parameters for data regression and communication error is evaluated over AWGN channel ranging from -15dB to 40dB SNR. The proposed system useful for the next generation low bandwidth communication system such as wireless systems developments, i.e., WiMAX and 4G, 5G, 6G.

Keywords: PCA, LDPC codes, Log-Domain Algorithm, SNR, BER, RMSE, QAM modulation,AWGN.

1. Introduction

In recent time wireless communication system are implemented with Multiple Input Multiple Output(MIMO) system[1].MIMO system enhances capacity(throughput) and reliability(decreases symbol error rate), which is proportional to the dimension of MIMO system i.e. the number of transmit-receive antennas. There are limitations at higher-dimensional MIMO, specifically spatial restriction for antenna deployment and complexity in signal processing at transceiver[2].

Low Density Parity-Check (LDPC) codes are perceived as the most dominant forward error correction codes, whose bit-error-rate (BER) execution is extremely close Shannon limit. LDPC-codes are demonstrated to have better performance and a considerable amount of points of interest other error correction codes such as Hamming codes, Turbo codes, Reed-Solomon and Reed-Muller codes. LDPC codes are broadly utilized in numerous applications for example ,Terrestrial television broadcasting system, digital satellite and Digital Video Broadcasting. Despite the fact that the decoding algorithm in LDPC is modest, but increasing the block length LDPC matrix becomes larger, and it is time consuming to physically connect and test the connections. The challenging parameter in designing of a fully parallel LDPC decoder is its complexity between its nodes inside the decoder. As continue expanding the square length it turns out to be practically troublesome and time taking to physically associate and check the interconnections.

Given the expanding number of applications require high-speed transmission without increasing the BW of the transmission channel,it is the explanation behind the utilization of high-order constellations. The Quadrature Amplitude Modulation (QAM), is exceptionally recommended as a