

Performance Enhancement of MIMO-MC-CDMA Systems by Employing Various Diversity Combining Techniques

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Abstract— Wireless communication is a system of transferring data from single point to other, without using similar wires, cables or any physical medium. In this paper, plain (MC-CDMA) scheme is implemented and the presentation in expressions of (BER) is achieved. The theoretical performance of the MC-CDMA scheme is also calculated and related using the simulated presentation to verify the accuracy of the system. Then, the MIMO systems are implemented and passed through the MCCDMA system with multiple input multiple output (MISO) antenna diversity and SIMO(single input multiple output) in the Rayleigh flat fading channel. The combination of MIMO and MC-CDMA scheme is named as MIMO-MC-CDMA system. By the side of the receiver, the acknowledged signals of MIMO-MC-CDMA system are united in the frequency domain in command to assemble the complete acknowledged signal energy spread on dissimilar subcarriers assuming flawless channel state information (CSI). The combining schemes used are the maximum ratio combining (MRC 1X2) with MIMO-MC-CDMA scheme, equal gain combining (EGC 1X2) with MIMO-MC-CDMA system, (MMSE 2X1) with the MIMO-MC-CDMA system, maximum likelihood combining (MLD 2x1,MLD 2x2) with MIMO-MC-CDMA system then the performance of these combining schemes will be measured with respect to the SISO-MC-CDMA systems at the receiver. The MLD (2x1) is combined with MLD (2x2).

Keywords— CDMA, OFDM, MC-CDMA, SISO, MIMO, MIMO-OFDM, STBC, EGC, MRC, MMSE, MLD, Diversity, BER.

I. INTRODUCTION

The world today is mostly dependent upon the Wireless Technologies due to their flexibility reliability, low cost and much easier way of deployment. Hence, it has become more important and only means of communications in most of the remote areas. Entire globe is dependent upon wireless communications which also includes homes, businesses etc. Satellite Communications which are a part of wireless

Communications provide way to several military, medical and commercial applications. Several Wireless technologies evolved based on the requirement of the speed, robustness and throughput. Various versions like 4g, VOLTE, 5G also evolved. Radio waves are propagated into the air in wireless communications. The signal may undergo reflections, refractions, scattering which may result in fading of the signal quality. Hence, to measure the quality of the signal, certain parameters have to be analysed.

CDMA is a 3G technology. It is multiple access technology in which different users are allocated different codes through the same communication channel

simultaneously. Advantage of this technology is that each symbol is multiplied to a code to generate the samples and the Bandwidth of the original signal is spread orthogonally between the codes. If the code length is N , then the bandwidth is spread by a factor of N . Disadvantages are near-far problem, Limited users, In CDMA, reverse link as users increases, BER (Bit Energy Rate) increases. Performances are worst as the number of users increases.

OFDM is 4G technology. it a frequency division multiplexing scheme in which digital information is encoded on multiple carrier frequency and a enormous figure of narrowly spaced orthogonal sub carrier signals carry information. Operation is a set of symbols loaded on to the sub carriers and s/p converted and IFFT is performed to generate the transmitted samples and converted to p/s (MUX) to generate serial stream. CP is applied and transmitted over the channel and remove C.P (to avoid IBI) and S/p (DeMUX & FFT) detection of symbols. P/s (MUX) to generate serial stream of data. Spatial efficiency decreases as we add C.P. Carrier frequency offset produces ICI in OFDM and thus introduces distortion and PAPR.

MC-CDMA is a mixture of CDMA and OFDM. At this