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PAPR REDUCTION USING MCS AND MCS-DHT TECHNIQUE IN STBC MIMO-OFDM SYSTEM

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ABSTRACT

The world has witnessed the rapid evolution of wireless communication systems as the demand for information and entertainment is growing extremely at a rapid pace regardless of the users' location. This trend continues to accelerate in today and the near future. Users embrace this new technological advancement and demand an efficient, reliable, and high-speed wireless communication network to satisfy their needs. One of the prominent solutions that could meet this demand is orthogonal frequency division multiplexing (OFDM) and multiple input multiple output (MIMO) technology. In addition, MIMO-OFDM is combined to promote the benefits of high-performance systems and exploitation of the multipath diversity, increasing data rates and link reliability. Despite all the advantages offered by the OFDM, it still suffers from a major problem which is the high peak-to-average power ratio (PAPR) and this problem continues to exist in MIMO-OFDM systems. The high PAPR in OFDM cause the efficiency of the high power amplifier (HPA) to decrease and increase power consumption. As a result, the high PAPR becomes a serious issue and the main barrier to the adaptation of OFDM multicarrier transmission in some wireless systems. Hence, median codeword shift (MCS) is proposed to reduce high PAPR problems in both OFDM and MIMO-OFDM systems with low computational complexity. In addition, embedded bit side information (SI) is adapted to improve the decoding reliability, which avoids bit error rate (BER) degradation at the receiver. With all the advantages possessed by the proposed MCS, a joint technique between MCS and discrete Hartley transform (DHT) is proposed to improve the PAPR reduction capability in DHT and simultaneously achieve a substantial PAPR reduction without compromising its BER performance. This research concludes with a performance comparison of the MCS and MCS-DHT with the effect of diversity schemes in MIMO-OFDM systems. In order to support the effectiveness of the proposed methods, PAPR and BER performances are analyzed to measure the percentage of improvement. From the overall experiment, the simulation results showed a significant improvement of MIMO-OFDM system performance of PAPR and BER by 33.9% and 66.7%, respectively.

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CHAPTER ONE
INTRODUCTION

1.1 Background Studies

The wireless communication system has come a long way since its inception, which revolutionised the way people communicate. A great leap in communication systems was observed when wireless communication was introduced, in which the world witnessed the transition from wired to wireless operation. With this technological advancement, users worldwide can be connected through short and long-range communication. The rapid development of wireless communications has contributed to the enormous growth in wireless users over the past few decades. With the recent lifestyle of modern society, high data rate wireless application such as internet access, multimedia stream and mobile computing has become inseparable from the daily lives of human beings. However, to provide users with high speed, reliable wireless communication experience, several technical challenges such as limited bandwidth and signal fading inherent to wireless channels need to be resolved.

These challenges could be overcome through a practical solution of MIMO and OFDM implementation. MIMO is a multiple antenna system invented to improve signal propagation for communication over the wireless channel by exploiting multipath propagation compared to the traditional single-antenna systems. By employing multiple transmit and receive antennas, the adverse effects of the wireless propagation environment can be significantly reduced. On the other hand, OFDM is perfect for a high data rate wireless system as a multicarrier modulation with high spectral efficiency. The concept of OFDM is to divide the radio channel into multiple narrowband, low rate, overlapped subchannels or subcarriers to allows multiple symbols to be transmitted parallelly while maintaining total bandwidth similar to conventional single-carrier modulation. On top of that, OFDM is also equipped with a unique feature that is immunity against frequency selective fading compared to single-carrier systems. Therefore, it makes sense why OFDM is adopted in most wireless broadband standards, including Third Generation Partnership Project Long Term Evolution (3GPP-LTE) and Worldwide Interoperability for Microwave Access (WiMAX) [1][2].