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REDUCTION OF INTERFERENCE USING UNIDIMENSIONAL INTERFERENCE ALIGNMENT SCHEME WITH RLS-MMSE EQUALIZATION TECHNIQUE IN STFBC MIMO-OFDMA SYSTEM

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ABSTRACT

In broadband wireless data services, the demand for the high data rates, improved coverage and quality of radio link have increased extremely. These system requirements can be met with the combination of two powerful technologies in the physical layer design; Multiple Input Multiple Output (MIMO) and Orthogonal Frequency Division Multiple Access (OFDMA). These marvel combination assures to provide the system with high data rates over frequency selective fading channels, and one of the leading candidates for the next generation of wireless communication systems. However, OFDMA inherits the infirmity of Orthogonal Frequency Division Multiplexing (OFDM) which is vulnerable to Carrier Frequency Offsets (CFO) and hence, generates Inter-carrier Interference (ICI) among achieved in the system when exploiting space, time, and frequency domains. Therefore, diversity order is applied to improve the system performance and at the same time, makes the system more robust to the ICI caused by CFO. In addition to that, the Inter-symbol Interference (ISI) is also being considered due to the fact that different mobile users will propagate through different channels and produce time dispersion of multipath channel. Based on these issues, the objective of this research is to mitigate the said interferences and achieves higher diversity order throughout the system. Essentially, ICI problem can be overcome through Unidimensional Interference Alignment (IA) scheme and RLS-MMSE equalization technique is proposed to mitigate the ISI problem, and at the same time Space Time Frequency Block Codes (STFBC) of diversity order technique is used to achieve full diversity order in the system. Overall, by using STFBC Unidimensional IA scheme with RLS MMSE equalization technique, the BER and PEP performance of the system is improved by 16.1 % and 36.8 % respectively.

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CHAPTER ONE
INTRODUCTION

1.1 INTRODUCTION

Successful deployment of wireless voice communication systems promises a bright future for wireless high data rate services such as internet access or multimedia applications [1]. To provide such high data rate services, Orthogonal Frequency Division Multiplexing (OFDM) is being considered as a good choice of this matter due to its ability to overcome multipath fading. Moreover, this brilliant OFDM communication system has been applied to various applications like Worldwide Interoperability for Microwave Access (WiMAX), digital audio/video broadcasting (DAB/DVB), wireless local area networks (WLANs) (e.g IEEE 802.11x and HIPERLAN/2), ultra-wideband based systems for short range wireless and the Long Term Evolution(LTE) for Fourth Generation(4G) in mobile network which is the latest one in recent developments of communication technologies [2].

There is currently a strong interest in extending the OFDM concept to multiuser communication scenarios. A prominent example of this trend is represented by the orthogonal frequency division multiple access (OFDMA) technology, which results from a combination of OFDM with a frequency division multiple access (FDMA) protocol [3]. An OFDMA system is defined as one in which each terminal occupies a subset of subcarriers (termed an OFDMA traffic channel), and each traffic channel is assigned exclusively to one user at any time [4]. In OFDMA, users are not overlapped in frequency domain at any given time [5]. However, the frequency bands assigned to a particular user may change over time.

Multiple input multiple output (MIMO) technologies have received increasing attentions in the past decades. Many broadband wireless networks have now included the MIMO option in their protocols. In principle, OFDMA and MIMO can be combined to offer the benefits of both system simplicity and high performance [6].