UNIVERSITI TEKNOLOGI MARA

INTERFERENCE REDUCTION USING ONE-THIRD ICI-SC SUBCARRIER MAPPING SCHEME IN STFBC MIMO-OFDMA SYSTEM

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ABSTRACT

Nowadays, the demand for multimedia wireless communication is growing extremely at a rapid pace and this trend is expected to continue in the future. The primary challenge is the demand for multimedia services accessed by many simultaneous users. A prominent example of this trend is orthogonal frequency division multiple access (OFDMA) technology. In addition, multiple input multiple output - orthogonal frequency division multiple access (MIMO-OFDMA) is combined to promote the benefits of simplicity, high performance system and exploitation of the multipath diversity which increases data rates and link reliability. Even though the OFDMA concept is simple in its basic principle, the design of a practical OFDMA system is far from being a trivial task. OFDMA is extremely sensitive to timing errors and carrier frequency offsets (FO) between the incoming waveform and the local references used for signal demodulation. Inaccurate compensation of the FO destroys orthogonality among subcarriers and produces inter-carrier interference (ICI) as well as inter-symbol interference (ISI). Hence, one-third inter-carrier self-cancellation (ICI-SC) subcarrier mapping scheme is proposed to reduce the effect of ICI with optimal distance between subcarriers in order to make an efficient transmission and at the receiver, minimum mean square error-decision feedback equalizer (MMSE-DFE) with affine projection algorithm (APA) filter is adapted at the receiver to reduce the effect of ISI by synchronizing local oscillation signal that has exactly the same carrier frequency and phase as carrier signal contained in the received signal. In order to optimize the system, step size is used to improve the system performance of MMSE-DFE(APA) equalizer. In addition, Sphere decoder (SD) is adapted to eliminate ISI as well as decoding computational complexity at the receiver by changing into less coding and less time taken to produce the output. Hence, it is important to have a robust algorithm for synchronization for the whole system. This research also concludes with comparison of the previous subcarrier mapping scheme, equalization and decoding technique with the effect of FO and diversity to MIMO-OFDMA system. Mobile WiMAX system parameter is used throughout this research as both transmitter and receiver implement OFDMA. In order to support the effectiveness of the proposed methods, PEP, BER and CIR performances are analysed to measure the percentage of improvement. From the overall experiment, the simulation results showed that there were significant improvement of MIMO-OFDMA system performance of PEP, BER and CIR by 85.7%, 28.4% and 222.5dB and effectively reduce the effect of ICI and ISI with less computational time in 150.25s and reducing coding complexity significantly.

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