On the Mitigation of Inter-carrier Interference for OFDM Systems

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Extended Abstract

Orthogonal Frequency Division Multiplexing (OFDM) is a multi-carrier modulation scheme that provides efficient bandwidth utilization and robustness against time dispersive channels. However, OFDM systems are more sensitive to the frequency offset than single carrier systems and the sensitivity increases with the number of sub-carriers and with the constellation size. Frequency offset results in the loss of orthogonality among sub-carriers and causes intercarrier interference (ICI). ICI has Gaussian statistics and affects both channel estimation and detection of the transmitted symbols. In this poster, we will present methods to mitigate the effects of ICI in the detection of symbols as well as in the channel estimation.

ICI Reduction using AR Modeling

Most of the ICI reduction methods model ICI as additive white Gaussian noise. Although ICI has the statistics of Gaussian distribution due to central limit theorem for sufficiently large subcarriers, it is not white. We have exploited the colored nature of ICI by modeling ICI as an auto-regressive (AR) process and whitening it. Although the proposed algorithm is intended to reduce the ICI, it will also reduce any kind of interference which is colored. Adjacent channel interference (ACI) and co-channel interference (CCI) are two examples that are colored in nature with high-pass and low-pass characteristics respectively. A two stage detection technique is employed. In the first stage, tentative symbol decisions are performed using initially received signal. Then, these initial estimates are used to estimate the ICI present on the current OFDM symbol. These estimates, then, are used to find the AR model parameters and to whiten the interference. After this process, the received signal with white noise are used in a second stage to provide symbol decisions.

ICI Cancellation Based Channel Estimation

Channel estimation is one of the most important elements of wireless receivers that employs coherent demodulation. For OFDM based systems, channel estimation has been studied extensively. However, the previous channel estimation algorithms treat ICI as part of the additive white Gaussian noise and these algorithms perform poorly when ICI is significant. We propose a novel channel estimation method that eliminates ICI by jointly finding the frequency offset and channel frequency response (CFR). The proposed method finds channel estimates by hypothesizing different frequency offsets and chooses the best channel estimate using correlation properties of CFR.