Performance optimization method in OFDM based on majorization and minimization technique

ABSTRACT

Phase Noise is considered a remarkable problem which causes significant degradation in detecting packet- based Orthogonal Frequency Division Multiplexing (OFDM) signals. Therefore, its estimation is essential to reduce the interference of channels in signals. Basically, this noisy signal might be entangled with OFDM signal according to many reasons. One of these important reasons is related to oscillator itself which generates the carrier signals and causes inter channel interference (ICI). The second main reason is multipath fading channel which causes a delay of OFDM signal and results of inter symbol interference (ISI). Another type of noise is known as Additive White Gaussian Noise (AWGN) or thermal noise whose effect is negligible comparing to phase noise. In this paper, we demonstrate and simulate a practical algorithm to mitigate phase noise which induces ICI .This algorithm is termed as Tight Quadratic Majorization (TQM) and is derived for phase noise estimation. Basically, TQM principles are based on time-domain OFDM symbols Majorization and Minimization (MM) technique. Therefore, we explain in details the behavior of the signal whose phase noise (PHN) is modeled as Wiener Process and channel is a Circularly Symmetric Complex Gaussian ( ).While, the channel impulse response is considered as static channel with slow-fading in its energy. Moreover, we clarify the idea of MM technique with its conditions. Then, we illustrate the derivation of TQM by the assumption of applying projection matrix whose maximum eigenvalue is one. Mainly, this assumption is utilized in order to simplify TQM derivation. Finally, we evaluate the OFDM modulation signal in time-domain at receiver-side. This signal is affected by large Wiener Process PHN and estimated by TQM algorithm. MATLAB simulation results reveal that TQM implementation has outperform to approximate PHN in OFDM systems with high number of subcarriers (Nc).

Keyword: Inter channel interference; Majorization-Minimization (MM); Orthogonal Frequency Division Multiplexing(OFDM) systems; Wiener Process PHN