

On Performance of Analog Network Coding in the Presence of Phase Noise

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Abstract:

Analog network coding (ANC) as a simple implementation of physical layer network coding (PLNC) based on orthogonal frequency division multiplexing (OFDM) has been proposed to increase the network capacity and reliability of bi-directional link between a pair of users. In ANC protocol, an information between a pair of users is exchanged through two orthogonal time phases (i.e., multicast and broadcast phase). On the other hand, the phase noise (PN) introduces phase offset and inter carrier interference (ICI) to the useful signal. Thus, in ANC scheme PN will affect the useful signal during both multicast and broadcast phase. In this paper, we present a performance analysis of ANC scheme using OFDM in the presence of PN in frequency-selective fading channel. We derive the total composite variance of ANC scheme in the presence of PN to obtain the signal-to-interference plus noise ratio (SINR) expression. Then, we evaluate the system's performance in terms of bit error rate (BER), SINR degradation and ergodic capacity through both numerical and computer simulation. Computer simulated average BER has been consistent with the numerical results, validating the presented analysis. Our results have shown that the ANC scheme is more sensitive to the PN introduced during the broadcast phase (i.e., at destination) than during the multicast phase (i.e., at relay). This is because of the higher ICI to the useful signal and enhanced noise due to the imperfect self-information removal at the destination. In addition, the performance degradation of ANC scheme based on OFDM in the presence of PN is highly expressed for the PN line width values up to 20 Hz.