
Multi-User Visible Light Communication Broadcast Channels With Zero-Forcing Precoding

Abstract:

This paper studies zero-forcing (ZF) precoding designs for multi-user multiple-input single-output visible light communication (VLC) broadcast channels. In such broadcast systems, the main challenging issue arises from the presence of multi-user interference (MUI) among non-coordinated users. In order to completely suppress the MUI, ZF precoding, which is originally designed for radio frequency (RF) communications, is adopted. Different from RF counterpart, VLC signal is inherently non-negative and has a limited linear range, which leads to an amplitude constraint on the input data signal. Unlike the average power constraint, obtaining the exact capacity for an amplitude-constrained channel is more cumbersome. In this paper, we first investigate lower and upper bounds on the capacity of an amplitude-constrained Gaussian channel, which are especially tight in the high signal-to-noise regime. Based on the derived bounds, optimal beamformer designs for the max-min fairness sum-rate and the maximum sum-rate problems are formulated as convex optimization problems, which then can be efficiently solved by using standard optimization packages.