

Compressive Sensing-Based Beamforming for Millimeter-Wave OFDM Systems

Abstract:

In this paper, we address codebook-based beamforming for multi-antenna orthogonal frequency division multiplexing (OFDM) systems operating in 60-GHz millimeter-wave band. Given a pre-specified codebook, the task of the beamforming process is to identify the best transmit and receive beam vectors to maximize the spectral efficiency. By properly modeling the multipath structure in 60-GHz channels, we transform the above task into the estimation of several sparse signal vectors. Furthermore, we tailor compressive sensing (CS) technology to efficiently estimate such sparse signals, wherein the CS measurement matrix is specifically designed by minimizing the inner products between different columns of the CS effective dictionary. As a result, CS-based iterative and non-iterative beamforming schemes are proposed. Due to the ability to judiciously exploit multipath sparsity inherent in 60-GHz channels, the proposed schemes significantly outperform the existing counterparts in terms of training overhead and success probability, which is confirmed by theoretical analysis and extensive simulations.