

Low Complexity Carrier Frequency Offset Estimation for Cooperative Orthogonal Frequency Division Multiplexing Communication Systems without Cyclic Prefix

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Abstract : Cooperative orthogonal frequency division multiplexing (OFDM) transmission, which possesses the advantages of better connectivity, expanded coverage, and resistance to frequency selective fading, has been a more powerful solution for the physical layer in wireless communications. However, such a hybrid scheme suffers from the carrier frequency offset (CFO) effects inherited from the OFDM-based systems, which lead to a significant degradation in performance. In addition, insertion of a cyclic prefix (CP) at each symbol block head for combating inter-symbol interference will lead to a reduction in spectral efficiency. The design on the CFO estimation for the cooperative OFDM system without CP is a suspended problem. This motivates us to develop a low complexity CFO estimator for the cooperative OFDM decode-and-forward (DF) communication system without CP over the multipath fading channel. Especially, using a block-type pilot, the CFO estimation is first derived in accordance with the least square criterion. A reliable performance can be obtained through an exhaustive two-dimensional (2D) search with a penalty of heavy computational complexity. As a remedy, an alternative solution realized with an iteration approach is proposed for the CFO estimation. In contrast to the 2D-search estimator, the iterative method enjoys the advantage of the substantially reduced implementation complexity without sacrificing the estimate performance. Computer simulations have been presented to demonstrate the efficacy of the proposed CFO estimation.

Keywords : cooperative transmission, orthogonal frequency division multiplexing (OFDM), carrier frequency offset, iteration

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