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MELIORATED MOE DETECTORS WITH CFO ESTIMATION FOR MC-CDMA SYSTEMS

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Abstract. *This paper presents two effective approaches to improve the minimum output energy (MOE) detector for multicarrier code-division multiple-access (MC-CDMA) systems in frequency-selective fading channels. A closed-form expression of the output signal-to-interference-plus-noise ratio (SINR) has been derived to illustrate the impact of carrier frequency offset (CFO) on the MOE detector. It shows that the performance degradation of the MOE detector may result from an inaccurate constraint vector. The major idea in this paper is to perform adaptive data processing for amending the impaired constraint vector so as to enhance the tolerance of the MOE detector toward the CFO effect, and thus provide the system robustness. Besides this, the subspace technique is further employed to eliminate the inter-carrier interference (ICI). It is shown that the ameliorated MOE detectors diminish not only the system sensitivity to CFO but also the finite sample effect significantly. Theoretical and numerical results have been presented to verify that the proposed detector substantially outperforms the conventional MC-CDMA detectors.*

Keywords: Multi-carrier code-division multiple-access (MC-CDMA), Carrier frequency offset (CFO), Inter-carrier interference (ICI), Minimum output energy (MOE), Subspace MOE (SMOE)

1. **Introduction.** A number of wireless applications have been widely developed during the recent decades, for example, mobile wireless networks [1], wideband wireless service [2,3] and wireless sensor networks [4-6]. For providing wideband wireless service, multi-carrier code-division multiple-access (MC-CDMA) [7,8] has been considered as an orthogonal-frequency-division multiplexing [3] (OFDM)-based multiuser system. The instinct of wideband wireless transmissions makes the mobile systems liable to suffer from performance degradation due to the frequency-selective multipath fading. However, in MC-CDMA systems, the frequency-selective fading channel is decomposed into a set of separate narrowband subchannels with orthogonality, and each subchannel bandwidth is designed to be less than the channel coherence bandwidth. This feature allows MC-CDMA for possessing the advantages of high bandwidth efficiency, simple channel equalization and robustness against frequency-selective multipath distortion. Although MC-CDMA