

For a massive multiple-input multiple-output (MIMO) system, restricting the number of RF chains to far less than the number of antenna elements can significantly reduce the implementation cost compared to the full complexity RF chain configuration. In this paper, we consider the downlink communication of a massive multiuser MIMO (MU-MIMO) system and propose a low-complexity hybrid block diagonalization (Hy-BD) scheme to approach the capacity performance of the traditional BD processing method. We aim to harvest the large array gain through the phase-only RF precoding and combining and then digital BD processing is performed on the equivalent baseband channel. The proposed Hy-BD scheme is examined in both the large Rayleigh fading channels and millimeter wave (mmWave) channels. A performance analysis is further conducted for single-path channels and large number of transmit and receive antennas. Finally, simulation results demonstrate that our Hy-BD scheme, with a lower implementation and computational complexity, achieves a capacity performance that is close to (sometimes even higher than) that of the traditional high-dimensional BD processing.