Hybrid Iterative Space-Time Equalization for Multi-User mmW Massive MIMO Systems

Abstract:

The combination of millimeter wave (mmW) with massive MIMO is a promising approach to achieve the multi Gb/s required by future wireless systems. Fully digital architectures are not feasible due to hardware limitations, and thus, the design of signal processing techniques for hybrid analog-digital architectures is of paramount importance. In this paper, we propose a new hybrid iterative block space-time receiver structure for multiuser mmW massive MIMO systems. We consider low-complexity user terminals employing analog-only random precoding and a single RF chain. At the base station, a hybrid analog-digital equalizer/detector is designed to efficiently remove the multiuser interference. The analog and digital parts of the equalizer are jointly optimized using as a metric the average bit-error-rate. The specificities of the analog domain impose several constraints in the joint optimization. To efficiently handle these constraints, the analog part is selected from a dictionary based on the array response vectors. We also propose a simple, yet an accurate semi-analytical approach for obtaining the performance of the proposed hybrid receiver structure. The results show that the performance of the hybrid iterative equalizer is close to the fully digital counterpart after only a few iterations. Moreover, it clearly outperforms the linear receivers recently considered for hybrid mmW massive MIMO architectures.