Underlay Cognitive Multihop MIMO Networks With and Without Receive Interference Cancellation

Abstract:

This paper investigates the impact of primary network interference on the performance of cognitive multihop secondary network under various multiple-input multiple-output (MIMO) approaches per hop. Specifically, the cognitive system involves a secondary network with MIMO relays that use the amplify-and-forward protocol, and each of which shares the same spectrum resources of multiple primary users (PUs) transmit and receive stations. Two different receive array conditions, and hence processing approaches, per hop in the secondary network are treated separately, which are maximal ratio combining for sufficiently spaced receive antennas to provide receive diversity gain and interference cancellation (IC) for insufficiently spaced antennas to reduce the effect of PUs interference. The latter approach involves two different algorithms that vary in terms of complexity and achieved performance, which are dominant receive IC and adaptive receive IC. Moreover, for both approaches, the transmit array gain is achieved per hop through the low-complexity transmit antenna selection. In doing so, new analytical results for multihop secondary network's end-to-end outage probability are developed. Moreover, simple asymptotic results for this outage performance in high SNR regime are provided, from which the achieved diversity and coding gains and the diversity-multiplexing tradeoff can be extracted. In addition, to further enhance the secondary network, optimal power allocation among hops is obtained based on the asymptotic outage performance under the constraints of transmit power of a secondary transmit station and interference limit on the primary network. The developed analytical results in this paper are validated through numerical and simulation results.