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Performance Analysis and Power Allocation for Underlay Cognitive MIMO Relaying Networks with Transmit Antenna Selection Under Antenna Correlation

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Abstract:

In this paper, we examine transmit antenna selection with receiver maximal ratio combining (TAS/MRC), and selection combining (TAS/SC) in underlay multiple-input multiple-output cognitive relay networks with decode-and-forward relaying protocol, considering optimal and suboptimal cases. The considered secondary user (SU) network consists of a source, a relay and a destination each equipped with multiple correlated antennas. On the other hand, the primary network is composed of L primary users (PU) destinations, each of which is equipped with multiple correlated antennas. The SU transmission power is limited to the minimum between the maximum allowable power for transmission and the maximum interference power allowed by the PU network. In the analysis, all the channel coefficients between the PU and SU networks and between the SU nodes are assumed to follow independent and identically distributed (i.i.d.) Rayleigh fading distribution. Hence, new exact closed-form expressions are derived to study the outage performance of the considered CRN system. Moreover, for the high SNR values, simple asymptotic expressions for the outage probability are obtained to get more insights on the characterization of the achievable diversity orders and coding gains. The impact of antenna correlation on the system outage probability is investigated for special correlation cases. To enhance SU network performance, a power allocation optimization problem is formulated to minimize the SU asymptotic outage probability by optimally distributing the SU power budget between the SU source and SU relay under the constraints of total allowable SU transmission power and maximum allowable PU interference limit. The derived analytical formulas herein are supported by numerical and simulation results to clarify the main contributions. The results show that although the antenna correlation harms the system coding gain, the considered system can still achieve a full

diversity order. Also, The results show that although the outage performance of optimal case outperforms the suboptimal case, the optimal case is more complicated compared to the suboptimal one. Moreover, the optimal power allocation solutions enhance the system outage performance compared to equal distribution model.

Reference:

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