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Evaluation of user selection schemes with low computational complexity and best effort interference

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ABSTRACT: A MIMO system is a wireless system, which employs multiple antennas at the transmitter and the receiver. MIMO is an acronym for "multiple-input multiple-output". Its main objective is the transmission and reception of signals at the physical layer of the wireless stack. Currently, MIMO have been made commercial, with examples being WiMAX and LTE, as well as WiFi and 802.11n. However, there is significant research to be undertaken with respect to handling interference.. Interference has been neglected in point-to-point MIMO as far as concurrent transmissions are concerned; thus, we are given the facts that MIMO offered the possibility of increased reliability through diversity and combination of gains. A technique to handle concurrent transmissions id cognitive radio, where nodes are separated to primary and secondary users competing for the channel medium. In this work, we tend to consider client decision courses for a various information different yield (MIMO) Cognitive radio (CR) downlink arrange, wherever the r-reception apparatus underlay CR auxiliary clients (SUs) exist with an essential client (PU), and each one terminals territory unit outfitted with numerous recieving wires. The Cognitive Radio Networks are composed of cognitive, spectrum devices capable of changing their configurations by spectral environment. The Spectrum sensing technique is the technique which optimize the sensing time, sensing threshold, and transmit power of a multi-input multi-output (MIMO) Cognitive Radio system for maximization of the opportunistic system throughput under transmit power, probability of false alarm, and probability of missed detection constraints. This work focuses on the problem in optimization for the optimal choice of the sensing threshold, sensing times, & transmits power in each spatial sub channel for both single-band and multi-band MIMO Cognitive Radio System. The author have a tendency to also consider helpful range detecting by abuse the FPT strategy in MU-MIMO CR framework. Helpful range detecting will enhance the execution of gathering. Moreover, with the particular agreeable range detecting approach, high probability of location will be accomplished once the framework is underneath notice requirement. This work entirely unexpected issues territory unit settled with the help of different destinations and getting diverse parameters.

KEYWORDS: Cognitive radio, spectrum underlay, user selection, MIMO broadcast channel.

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I. INTRODUCTION

COGNITIVE radio (CR) systems enhance the efficiency of spectrum utilization by allowing a set of unlicensed/secondary users (SU), opportunistic access of the vacant spectral bands. Hence, it is imperative for the SUs in CR systems to reliably sense the wireless channel towards detection of weak primary user (PU) signals [2], thus avoiding interference to the licensed users. Several spectrum sensing techniques [3], [4] have been proposed in existing literature and these can be broadly classified as being local or cooperative in nature. It has been demonstrated that cooperative schemes result in a superior detection performance compared to local techniques since the former possess the ability to overcome the wireless impairments of shadowing, fading and hidden terminals, thus improving the sensing reliability. Amongst such cooperative schemes, soft-decision based maximal ratio combining [5] has been demonstrated to achieve the lowest detection error. However, its performance depends critically on the accuracy of the channel state information (CSI) available. Obtaining perfect CSI in multiuser wireless communication scenario is a challenging task due to the time varying nature of the wireless channel. Hence, optimistically, it is only possible to obtain nominal channel estimates in practical wireless systems. In this context we present a class of optimal detectors for non-antipodal signaling based multiple-input multiple-output (MIMO) cooperative spectrum sensing scenarios considering uncertainty in the available channel estimates. We model the inaccuracies in the channel coefficients as ellipsoidal uncertainty sets centered at the nominal channel estimates. It is demonstrated that the problem of optimal PU detection can be formulated as a second order cone program (SOCP). We describe a closed form solution for the proposed robust detector. Subsequently we also present the allied relaxed robust detector (RRD) and multicriterion robust detector (MRD) for PU detection in adverse deep fade and CSI uncertainty scenarios. Simulation results demonstrate that the proposed robust cooperative detectors have a significantly superior performance compared to the conventional matched filter (MF) detector. The rest of the letter is organized as follows. Section II describes the system model for cooperative spectrum sensing in MIMO CR wireless networks followed by the uncertainty model for the channel estimates .

II. COMMUNICATION CHANNEL, MIMO AND MU-MIMO

In 1948, Claude Shannon [C. E. Shannon, 1948] pioneered the mathematical theory of communication which is based on the concept of mutual information between the input and output of a channel. It is evident that the theory has formed a basis for analyzing the performance of both wired and wireless communication systems. The essence of the theory is the concept of channel capacity which is defined as the maximum data rate over a channel with asymptotically small error probability. In a typical communication system with the additive white Gaussian noise (AWGN) channel as shown in Figure 1.1, the relationship between the output signal and input signal can be expressed as [10]

$$y = x + n, \tag{1.1}$$

Where *y* denotes the output signal, *x* denotes the input signal and *n* denotes the AWGN noise. That is, the output of the system is the summation of input *x* and AWGN noise *n*. Assume that the signal-to-noise ratio (*SNR*) is the ratio of the power of the output signal in Watts to the power of the noise in Watts, and *B* is the channel bandwidth in Hz, Shannon capacity in bits per second (bps) of such a channel is given below [11]

$$C = B\log2\ (1 + SNR). \tag{1.2}$$

Since Shannon capacity is the maximum data rate that a communication system can achieve with near zero error probability, the data rate achieved in a practical system is inevitable lower than the Shannon capacity due to the limitation of channel bandwidth and signal power. In other words, Shannon capacity is generally used as an upper bound on the achievable data rate in a real system.

Shannon capacity limit can be applied as the upper bound of a wireless system, such as a cellular system shown in Figure 1.

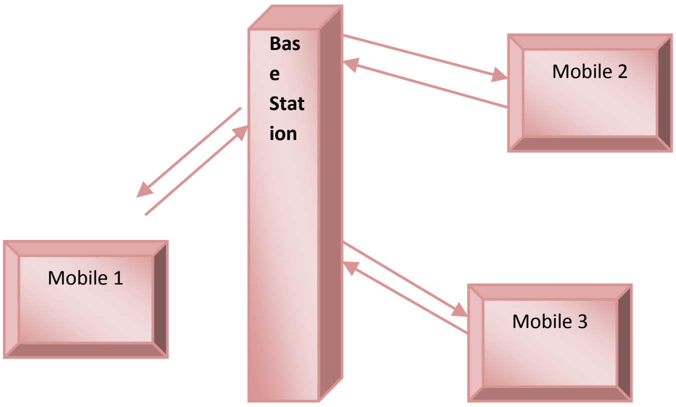

Figure 1. Wireless cellular system

III. MULTIPLE-INPUT MULTIPLE-OUTPUT SYSTEMS

Where there are more than one antenna at either end of the radio link, this is termed MIMO - Multiple Input Multiple Output. MIMO can be used to provide improvements in both channel robustness as well as channel throughput.

MIMO - Multiple Input Multiple Output

In order to be able to benefit from MIMO fully it is necessary to be able to utilise coding on the channels to separate the data from the different paths. This requires processing, but provides additional channel robustness / data throughput capacity.

There are many formats of MIMO that can be used from SISO, through SIMO and MISO to the full MIMO systems. These are all able to provide significant improvements of performance, but generally at the cost of additional processing and the number of antennas used. Balances of performance against costs, size, processing available and the resulting battery life need to be made when choosing the correct option.

IV. RESULT & DISCUSSION

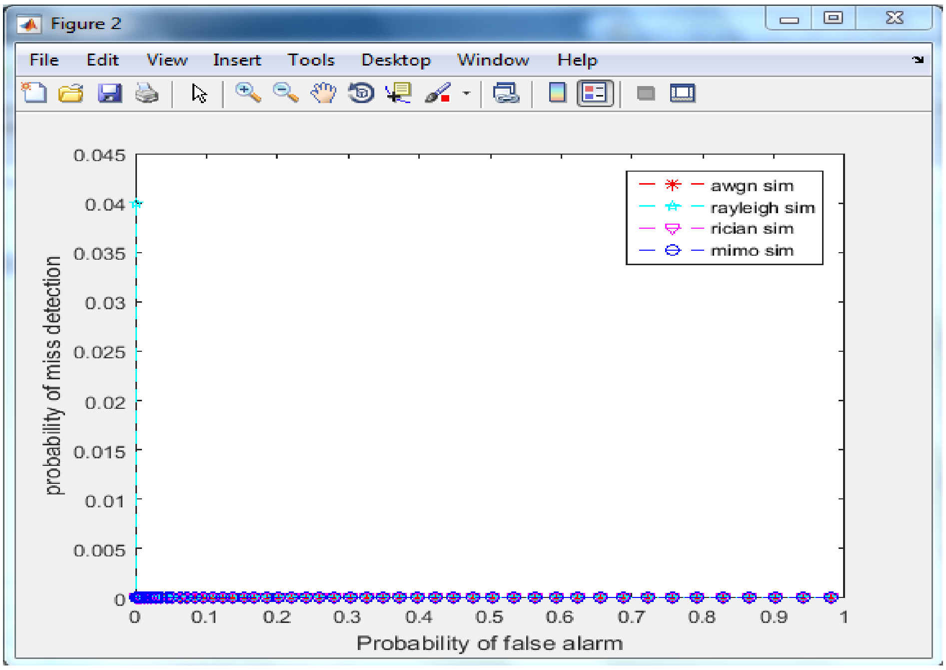

Figure 2: Probability of Miss detection

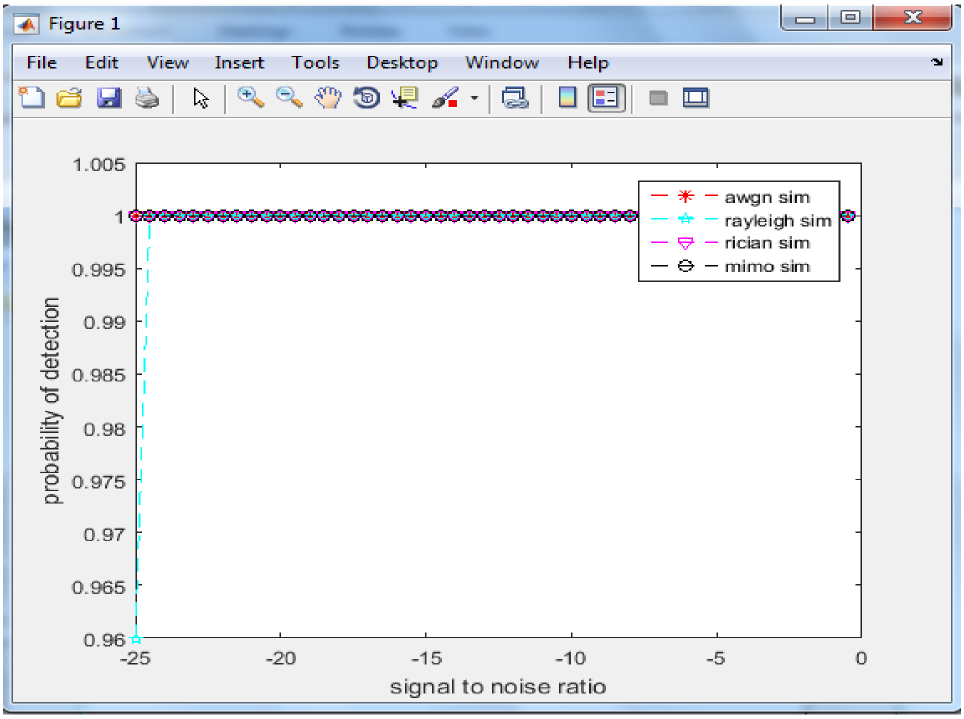

Figure 3: Probability of detection vs. signal to noise ratio

The figure 2 defines the detection of miss detection with false alarm rate. In the figure 2 add white Gaussian noise simulation, Rayleigh simulation, rician simulation and MIMO simulation is defined . But in the figure 3 signal to noise ratio is -24 and probability of detection is constant that is 1.

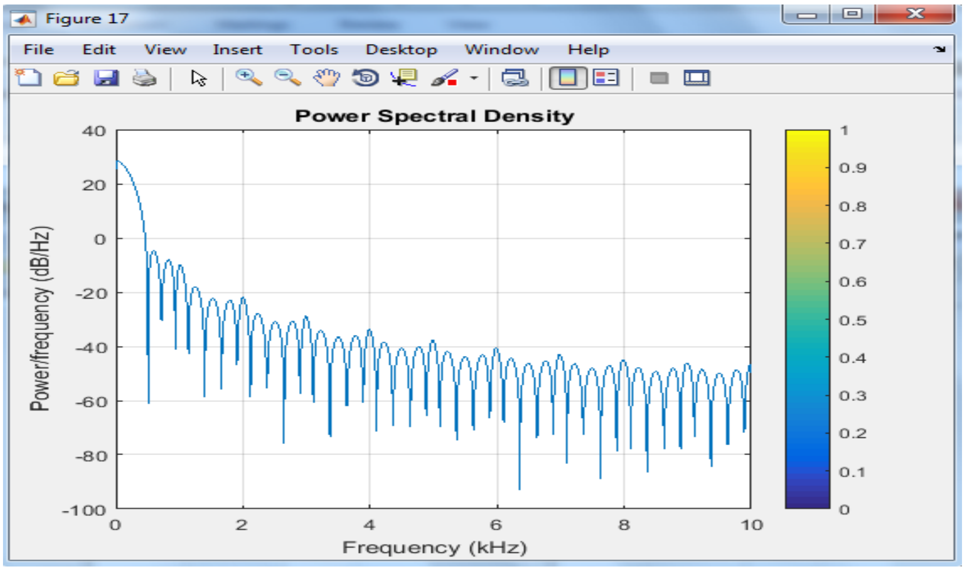

Figure 4: power vs. frequency for PSD

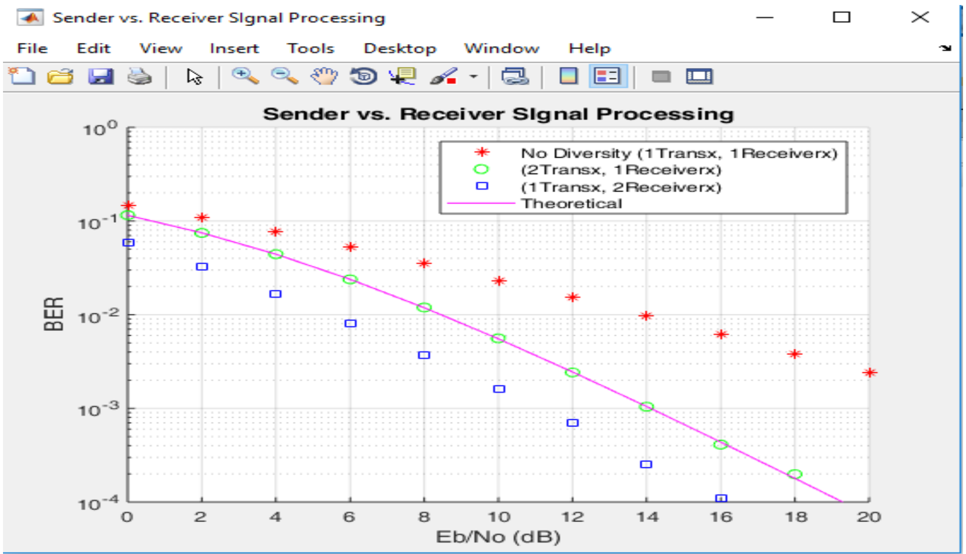

Figure 5: Bit error rate vs. Eb/No(dB)

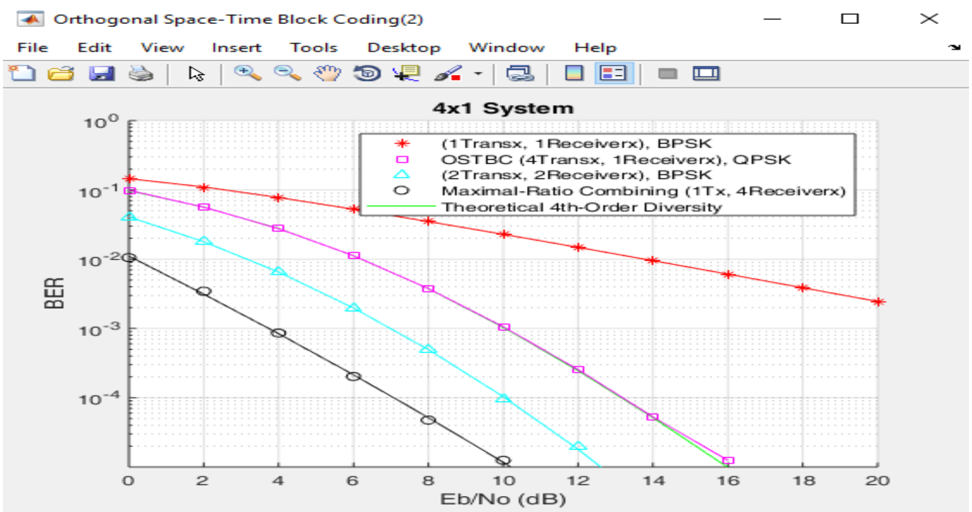

Figure 6: Bit error rate vs. Eb/No(dB) for OSTBC transmitter and receiver

The figure 4 defines the power spectral density for power and frequency . The figure 5 defines the bit error rate along with Eb/No. It is the transmitter and receiver processing bit error rate . But the figure 6 is the transmitter and receiver BPSK and OSTBC processing along with bit error rate and Eb/No.

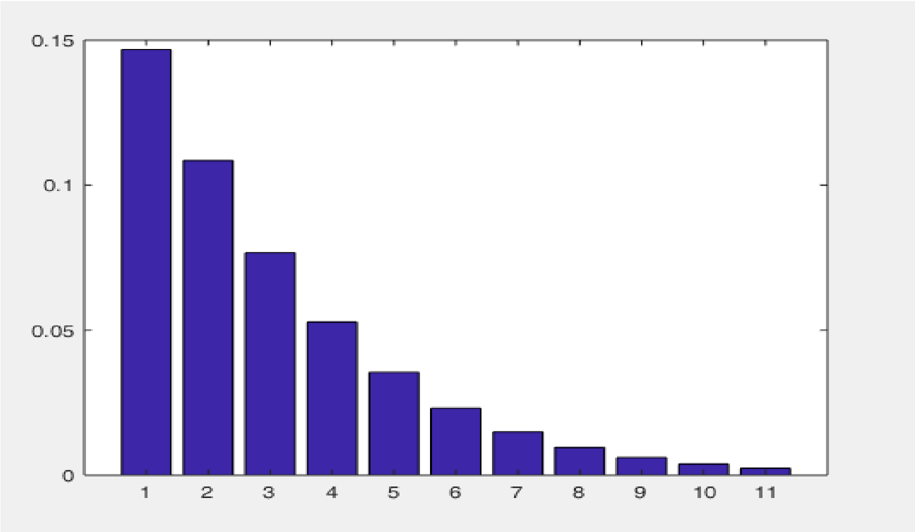

Figure 7(a) : Bit Error rate for 1 transmitter and 1 receiver

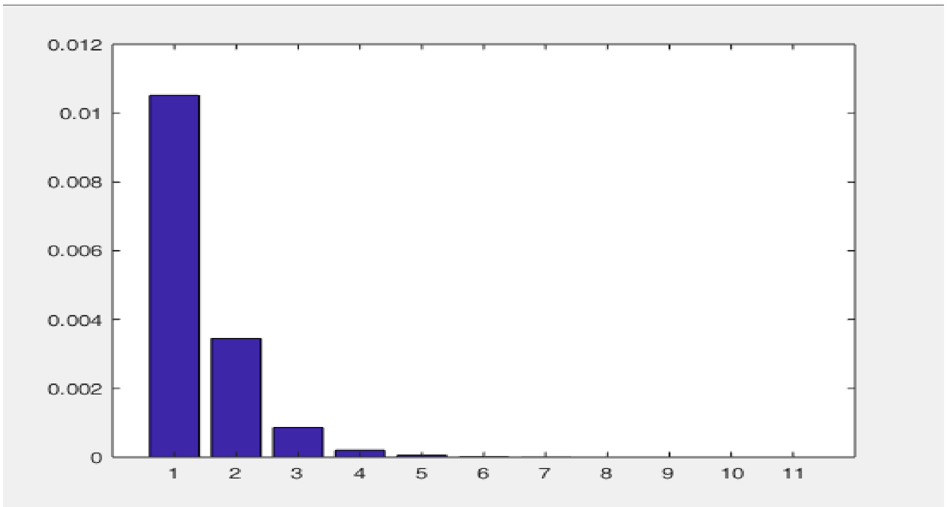

Figure 7(b) : Bit Error rate for 1 transmitter and 4 receiver

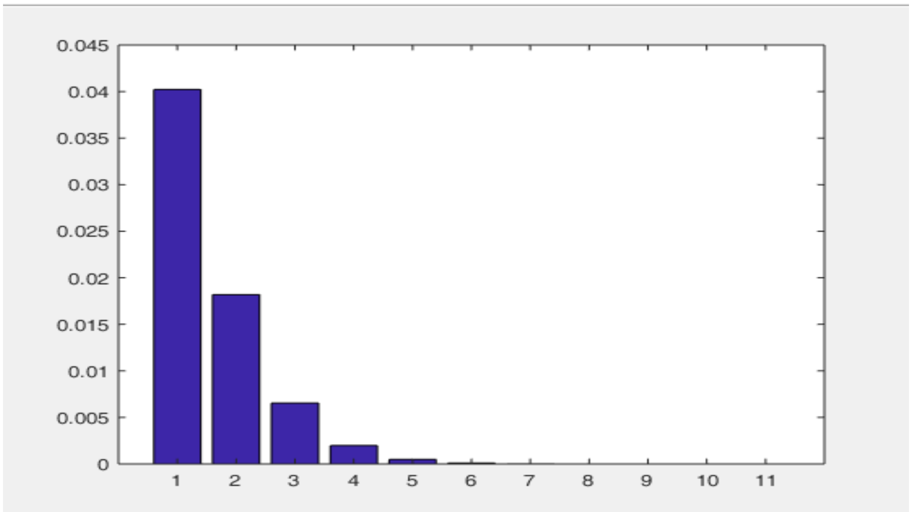

Figure 7(c) : Bit Error rate for 2 transmitter and 2 receiver

The figure 7(a) : Bit Error rate for 1 transmitter and 1 receiver , the figure 7(b) : Bit Error rate for 1 transmitter and 4 receiver and the figure 7(c) : Bit Error rate for 2 transmitter and 2 receiver . In this figures different values are coming along with bit error rate 1 , 2 and 4 transmitter and receiver.

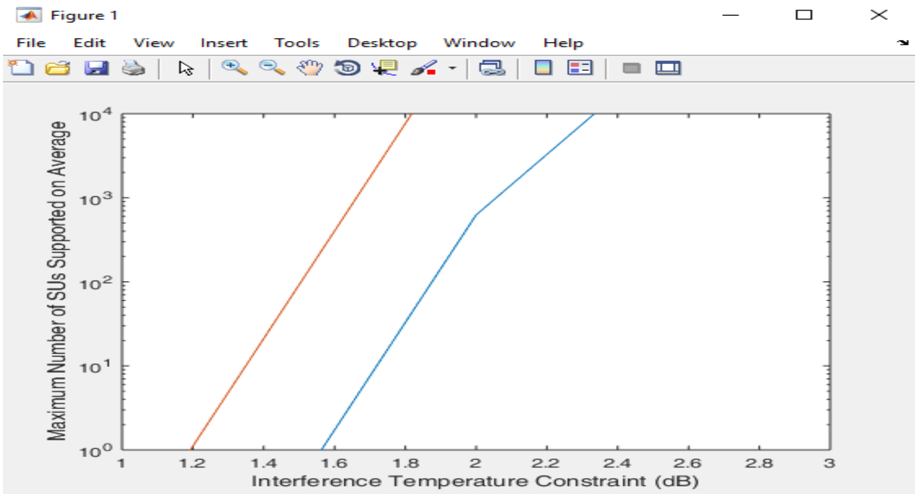

Figure 8: Max. Number of secondary user supported on Average

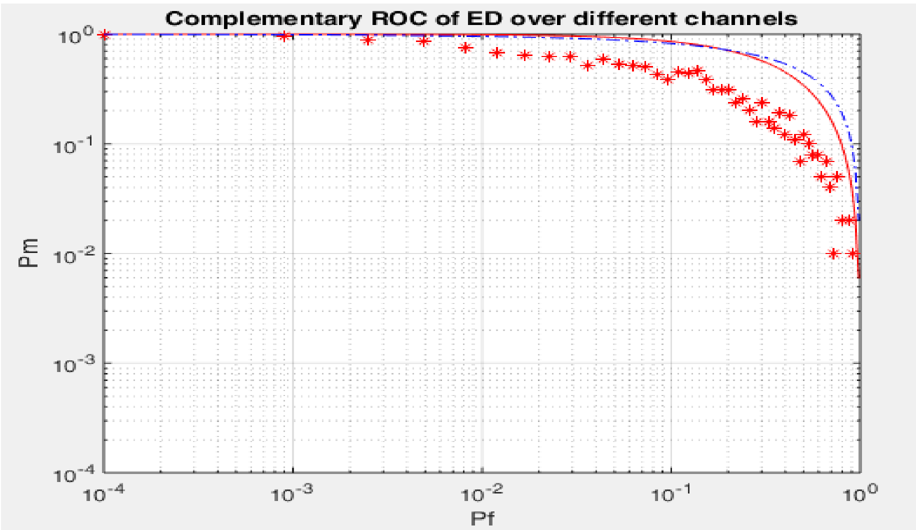

Figure 9: Complementary ROC of ED over different Channels

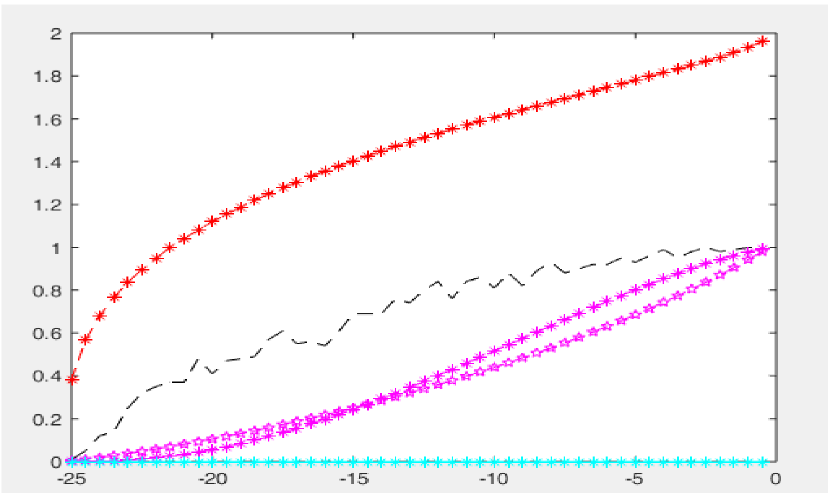

Figure 10: plot of snr1, Pd_sim_awgn, Pd_theory_rayleigh, Pd_appm_awgn, Pd_theory_awgn and Pd_sim_rician

The figure 10 is the processing of snr1, Pd_sim_awgn, Pd_theory_rayleigh, Pd_appm_awgn, Pd_theory_awgn and Pd_sim_rician. Here different color line displays the different values of SNR.

V. CONCLUSION

A cooperative game is formulated to solve the spectrum sharing problem for multiple secondary users in a MIMO cognitive radio network. Each secondary transmitter adjusts its transmit covariance matrix to increase the utility under both transmit-power and total interference-power constraints. In this paper, we have considered the sum rate maximization problem for downlink transmission of MIMO CR networks in the presence of multiple SUs and PUs. The design problem is subject to per-antenna power constraints at the secondary BS and interference constraints at the PUs. The proposed algorithm was numerically shown to have a superlinear convergence behavior which is almost independent of the problem size. Through numerical experiments, we have illustrated how the performances of the secondary and the primary systems vary with the type of the interference constraints considered in the paper. In particular, we have shown that the performance of the secondary system degrades significantly and reaches a saturated value when either the number of primary users or the number of antennas at the primary user is large. Also, we have discussed different ways of controlling amount of the interference caused by the secondary system. Specifically, we have concluded that using the trace of the interference matrix may reflect the interference situation better, compared to using the largest eigenvalue.

In this work totally extraordinary issues are settled with Frequency and PU's and SU's. Amid this work totally extraordinary diagrams are ascertained with the help of different parameters and that we are turning into the 80% exactness of transmission of PU's and SU's with intellectual radio recurrence.

FUTURE SCOPE

An interesting topic for future research is the extension of the proposed approach to simultaneous CR data transmission and spectrum sensing to systems comprising multiple CR MIMO transmitters, multiple CR MIMO receivers, and multiple PUs.

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