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Multi User And Multi Channel Using Beam Forming Based Power And Channel Allocation On MISO System

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Abstract—**Primary user's spectrum can be reused by the secondary user transmitters to maximize the spectrum utilization while the intra-user interference is minimized by implementing beam forming at each secondary user transmitter. After formulate process on cognitive radio network, we implement beam forming structure on particular user based particular distance analysis on singular value decomposition (SVD) using receiver part of analysis. In the modification, multi channel on multiple user analysis of relay path can be implemented based through put rate analysis on cognitive radio network using MISO system on singular value decomposition.**

Index terms—**Beamforming, Cognitive Radio Network, MISO, Primary User, Singular Value Decomposition.**

I. INTRODUCTION

FOR an underlay cognitive radio network (CRN) coexisting with a multichannel primary user (PU) network, managing interference is a critical issue since spectrum reusing among multiple users may cause negative effects on received signals at both primary users and secondary user (SU). By exploiting multiple antennas, a signal processing technology called beam forming has been introduced to cognitive radio for directional signal transmission, so as to effectively mitigate the mutual interference and improve the throughput rate.Wireless networks are based on multi-hop communications, where the information from the source to the destination is relayed via other mobiles Multi-hop ideas are also utilized in cellular and wireless LAN systems to provide higher quality of service, power savings and extended coverage.

Beamforming vectors were calculated by using an iterative algorithm based on semidefinite programming to maximize the sum-rate with a total power constraint `and co-channel interference constraints at both PU and SU receivers. This work was further extended in by adding an extra quality of service (QoS) constraint. However, the assumption of a single PU channel as used in reduces the degree of freedom available at the secondary base station (SBS) on channel allocation for SUs.

Beamforming was implemented by the SU-TX to minimize the interference to the PU-RXs while the received signal strength was maximized at the SU-RX, transmit power minimization problem with a guarantee of SUs' QoS and total power constraints in a multiple channels multiple-input-single-output (MISO) CRN. Some other works in this area include an adaptive intercell interference cancellation (ICIC) technique for MISO downlink cellular systems with channel allocation and beamforming to maximize the weighted sum-rate. Beamforming is used to control the directionality of the reception or transmission of a signal on a transducer array. Beamforming can be used at both the transmitting and receiving ends in order to achieve the spatial diversity with higher throughput.

However, most of these works assumed a cellular architecture for secondary networks, where either SU-Tx or SU-Rx is the secondary base station. Recently, device-todevice (D2D) communication based secondary networks, areattractingmoreattentionsfromresearchersduetotheir advantages in offering greater coverage with spatial diversity, higher data rates and lower energy consumption. Different fromthetraditionalcellulararchitecture,D2Dcommunications cause co-channel receivers interfered by multiple transmitters at different locations. This challenge requests the consideration of individual SINR constraint at each SU-Rx, and makes the joint beamforming and resource allocation more complicated than the traditional case.Beamforming is performed by each SU-TX instead of a single SBS so as to promote the spatial diversity and curtail the interference. Our main objective is to maximize the sum-rate of the secondary network while minimizing the intra-user interference subject to the constraints of total power budget, interference on PUs and SINR requirement at each SU.

Using beamforming we can allocate more power and channel to secondary users with higher throughput rate.The cooperative communication involves two main ideas. First is use relays (or multi-hop) to provide spatial diversity in afading environment and second is envision a collaborative scheme where the relay also has its own information to send so both

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terminals help one another to communicate by acting as relays for each other. Multiple antennas may be used to perform smart antenna functions such as spreading the total transmit power over the antennas to achieve an array gain that incrementally improves the spectral efficiency or achieving a diversity gain that improves the link reliability.

II. EXISTING SYSTEM

Without beam forming Using Channel allocation on multiple users using co-operative system on orthogonality under realistic conditions.Cooperative diversity systems rely on using relay nodes to relay copies of transmitted information to the destination such that each copy experiences different channel fading, hence increasing the diversity of the system. However, without proper processing of the message at the relays, the performance of the cooperative system may not necessarily perform better than direct transmission systems. In this system i.e. without beamforming they do not achieve sufficient throughtput rate or sum rate to secondary users.
The drawbacks of this existing system are 1)Secondary User (Out off Coverage User) they are not getting sufficient result. 2)Orthogonality between Primary User's (PU) to Secondary User's (SU) is lost in realistic communication systems.3)Performance of Cooperative Communication is degraded.

III. PROPOSED SYSTEM

Singular value decomposition (SVD) using relay path analysis on Multiple input single output (MISO) System Using Beam forming on Channel Allocation in Cognitive Radio Networks. With the capability of beamforming at each secondary user transmitter to mitigate interference, allow more transmission opportunities and exploit the benefits of spatial diversity or beamforming.

A. ADVANTAGES

The advantages of proposed system of this paper is

1)Signal Coverage Area Improvement
2)Time Duration is less
3)Through put rate more on CR network secondary users.

IV. BLOCK DIAGRAM

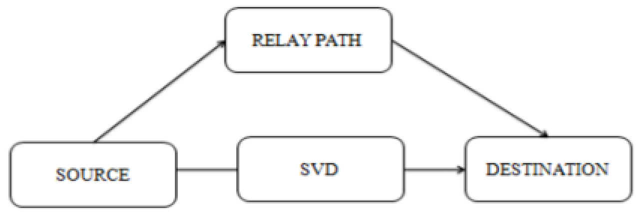

Fig 1 Block Diagram

Beamforming is a general signal processing technique used to control the directionality of the reception or transmission of a signal on a transducer array. Using beamforming you can direct the majority of signal energy you transmit from a group of transducers (like audio speakers or radio antennae) in a chosen angular direction.Relay path is an antenna which is used to communicate secondary users with primary users.MISO system has multiple antennas at the transmitter and single antennas at receiver site.MISO is a method of transmitting multiple data streams at the transmitter side and also receiving multiple data streams at the receiver side. MIMO antenna configuration describes that use of multiple transmit and multiple receive antennas for a single user produces higher Capacity, spectral efficiency and more data rates for wireless communication.

V. BEAMFORMING

Beamforming is a general signal processing technique used to control the directionality of the reception or transmission of a signal on a transducer array. Using beamforming you can direct the majority of signal energy you transmit from a group of transducers (like audio speakers or radio antennae) in a chosen angular direction. Or you can calibrate your group of transducers when receiving signals such that you predominently receive from a chosen angular direction.
The basic point in beamforming is, when you set multiple transducers next to each other sending out signals, you're going to get some kind of interference pattern, just like you see in a pond when you throw several stones in at once and create interfering ripples.
If you select the spacing between your transducers and the delay in the transducers signals just right, you can create an interference pattern that's to your benefit, in particular one in which the majority of the signal energy all goes out in one angular direction.
The sin waves below are moving out from all the sources just like ripples do in a pond, and I'm going to assign variables to my arrangement rather than numbers, so that I can change them and see how those changes affect my overall resulting interference pattern. So note I have a constant spacing d between each of my transducers (point sources here), and an

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origin of some coordinate system centered on the center transducer.

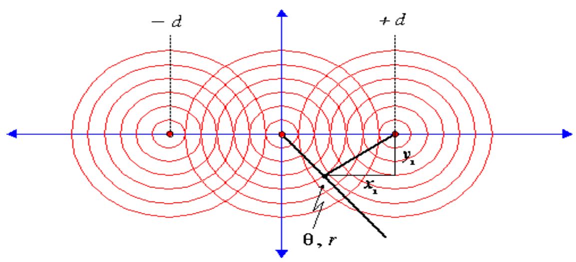

Fig 2Beamforming Arrangement

To change the directionality of the array when transmitting, a beamformer controls the phase and relative amplitude of the signal at each transmitter, in order to create a pattern of constructive and destructive interference in the wavefront. When receiving, information from different sensors is combined in a way where the expected pattern of radiation is preferentially observed.

For example in sonar, to send a sharp pulse of underwater sound towards a ship in the distance, simply transmitting that sharp pulse from every sonar projector in an array simultaneously fails because the ship will first hear the pulse from the speaker that happens to be nearest the ship, then later pulses from speakers that happen to be the further from the ship.

The beamforming technique involves sending the pulse from each projector at slightly different times (the projector closest to the ship last), so that every pulse hits the ship at exactly the same time, producing the effect of a single strong pulse from a single powerful projector. The same thing can be carried out in air using loudspeakers, or in radar/radio using antennas.

In passive sonar, and in reception in active sonar, the beamforming technique involves combining delayed signals from each hydrophone at slightly different times (the hydrophone closest to the target will be combined after the longest delay), so that every signal reaches the output at exactly the same time, making one loud signal, as if the signal came from a single, very sensitive hydrophone. Receive beamforming can also be used with microphones or radar antennas.

With narrow-band systems the time delay is equivalent to a "phase shift", so in this case the array of antennas, each one shifted a slightly different amount, is called a phased array. A narrow band system, typical of radars, is one where the bandwidth is only a small fraction of the centre frequency. With wide band systems this approximation no longer holds, which is typical in sonars.

A. OPTIMAL BEAMFORMING ALGORITHM

The joint source-relay beamforming design for the three-node MIMO DF relay network with source-destination direct link. We assume that both the source and relay nodes are equipped with multiple antennas while the destination node is only deployed with single antenna.

Such a transmission scenario is readily applicable to the downlink transmission of a relay-enhanced cellular system where the base-station and the relay can accommodate multiple antennas but the mobile user equipment can only afford a single antenna due to size or other constraints. Downlink transmission to resource-limited mobile terminals limits the overall performance of cellular systems.

Christo Ananth et al. [10] discussed about Improved Particle Swarm Optimization. The fuzzy filter based on particle swarm optimization is used to remove the high density image impulse noise, which occur during the transmission, data acquisition and processing. The proposed system has a fuzzy filter which has the parallel fuzzy inference mechanism, fuzzy mean process, and a fuzzy composition process. In particular, by using no-reference Q metric, the particle swarm optimization learning is sufficient to optimize the parameter necessitated by the particle swarm optimization based fuzzy filter, therefore the proposed fuzzy filter can cope with particle situation where the assumption of existence of "ground-truth" reference does not hold. The merging of the particle swarm optimization with the fuzzy filter helps to build an auto tuning mechanism for the fuzzy filter without any prior knowledge regarding the noise and the true image. Thus the reference measures are not need for removing the noise and in restoring the image. The final output image (Restored image) confirm that the fuzzy filter based on particle swarm optimization attain the excellent quality of restored images in term of peak signal-to-noise ratio, mean absolute error and mean square error even when the noise rate is above 0.5 and without having any reference measures.

We would like to stress that deriving the explicit expressions of the optimal beamforming design for our concerned model with single-antenna destination node is by no means trivial. This is because the MIMO channel between the source and the relay nodes and the multiple-input multiple-output (MISO) channel between the source and the destination nodes have to be jointly considered and balanced.

For a better understanding of the optimal be`amforming design, we do not follow some commonly used approaches, such as the semi-definite relaxation (SDR) method. Instead, we first examine the properties of the optimal solutions. We

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effectively separate the phase angle design and real norm d

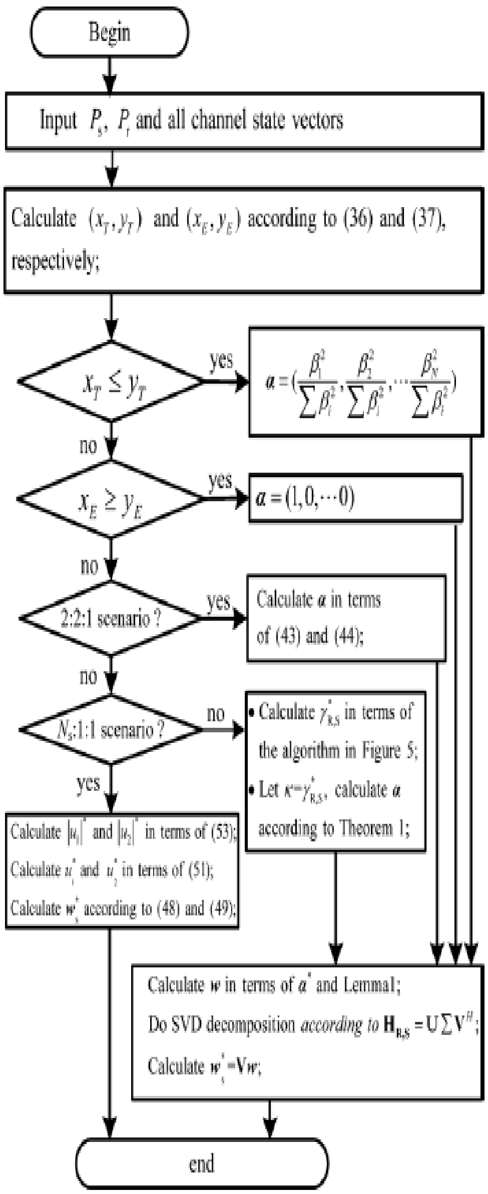

Fig 3 Flowchart For Optimal Beamforming Algorithm

We also prove that the signal to noise ratio (SNR) of the MISO relay to destination channel can be regarded as a concave function of the SNR of the MIMO source to relay channel.

B. SINGULAR VALUE DECOMPOSITION (SVD)

In linear algebra, the singular value decomposition (SVD) is a factorization of a real or complex matrix, with many useful applications in signal processing and statistics.
Formally, the singular value decomposition of an m × n real or complex matrix M is a factorization of the form M = UΣV∗, where U is an m × m real or complex unitary matrix, Σ is an m × n rectangular diagonal matrix with non-negative real numbers on the diagonal, and V∗ (the conjugate transpose of V, or simply the transpose of V if V is real) is an n × n real or complex unitary matrix. The diagonal entries Σi,i of Σ are known as the singular values of M.
The m columns of U and the n columns of V are called the left-singular vectors and right-singular vectors of M, respectively. The singular value decomposition and the Eigen decomposition are closely related. Namely:

- The left-singular vectors of M are eigenvectors of MM∗.
- The right-singular vectors of M areeig`envectors of M∗M.
- The non-zero singular values of M (found on the diagonal entries of Σ) are the square roots of the non-zero Eigen values of both M∗M and MM∗.

The singular value decomposition (SVD) involves t`he factorization of a real or complex rectangular matrix with many applications in image processing, signal processing and statistics.

VI. MISO

MISO is an antenna technology for wireless communications in which multiple antennas are used at the source (transmitter). The antennas are combined to minimize errors and optimize data speed. The destination (receiver) has only one antenna. MISO is one of several forms of smart antenna technology, the others being MIMO (multiple input, multiple output) and SIMO (single input, multiple output).
In conventional wireless communications, a single antenna is used at the source, and another single antenna is used at the destination. In some cases, this gives rise to problems with multipath effects. When an electromagnetic field (EM field) is met with obstructions such as hills, canyons, buildings, and utility wires, the wavefronts are scattered, and thus they take many paths to reach the destination. The late arrival of scattered portions of the signal causes problems such as fading, cut-out (cliff effect), and intermittent reception (picket fencing).
In digital communications systems such as wireless Internet, it can cause a reduction in data speed and an increase in the number of errors. The use of two or more antennas, along with the transmission of multiple signals (one for each antenna) at

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the source, can reduce the trouble caused by multipath wave propagation.

The MISO capacity is given by,

$$C=MtBlog2\ (1+S/N) \quad (3)$$

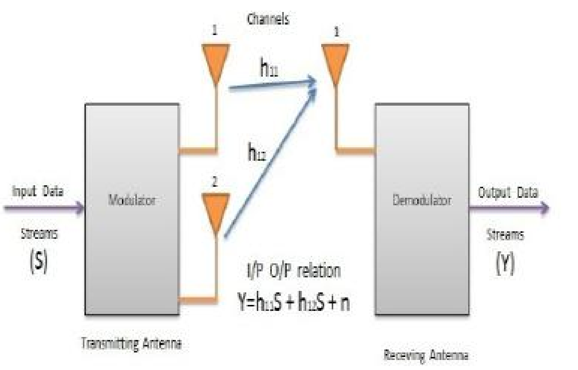

Fig 4 MISO Configuration

MISO system has multiple antennas at the transmitter and single antennas at receiver site. Now we assume we have two transmitting signals "S1" and „S2" with different fading channel coefficient „h1" and „h2" with output data stream „Y". Antenna configuration and input output relation of MISO (Transmit Diversity) is illustrated in the figure.

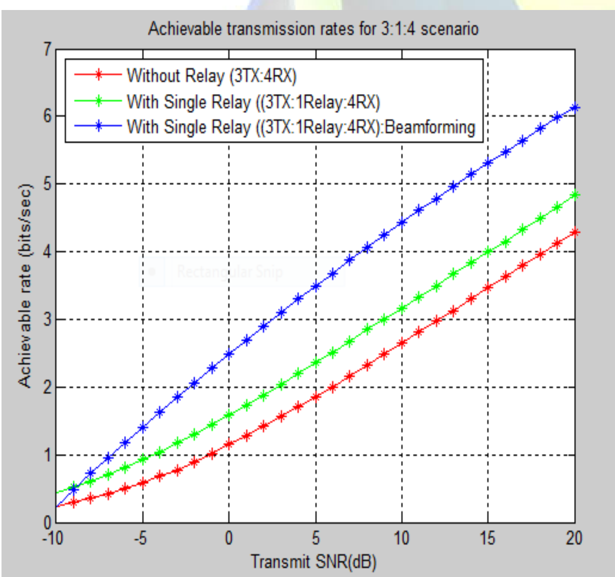

Fig4 Comparison of sum rate variation forPU ZFBF and proposed system modelwith single relay and N=4 receivers

VII. SIMULATION RESULTS

The proposedmodeloutperformstheZero Forcing Beam Forming (ZFBF) scenario irrespective to the channel allocation algorithms. It is because the degrees of freedom available on channel allocation in our proposed system model are much greater than those in the ZFBF model

Theperformance ofachievable sum-ratewith respectto thenumber of transmit antennas. The figure depicts that the sum-rates are increased with the number of antennas(J). It is because once J increases, the transmitter can direct the signal with better intensity to the intended receiver and at the same time further suppress the interference to the other users who are using the same channel. the proposed beamforming method with another ZFBF scenario with respect to the number of SU pairs and the number of antennas, respectively. The beamforming vectors in this ZFBF scenario are determined by eliminating the interference at each PU-Rx. Similar, it is obvious that our proposed algorithm can outperform the primary user ZFBF scenario regardless of thechannel allocation algorithms.

In the 3:1:6 scenario achievable transmission rate, without relay the throughput rate is not achieved to secondary users. With relay, throughput rate is little high which is compared to without relay. With relay and beamforming, the sum rate is very high and the power and channel is allocated to secondary users.

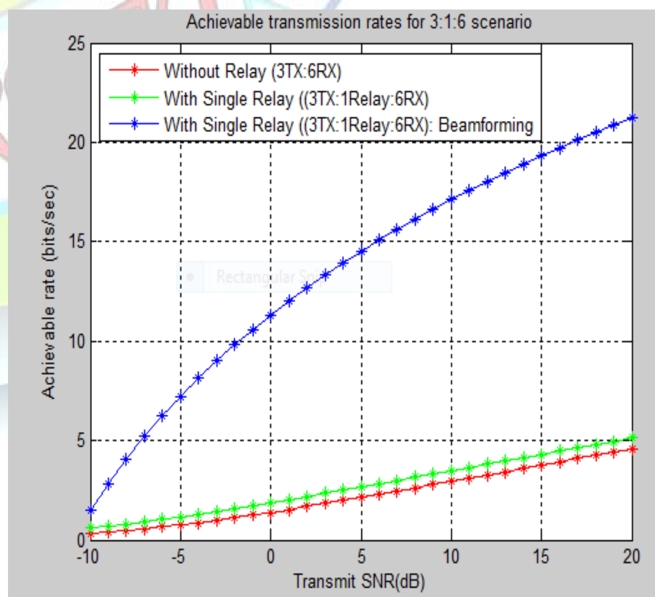

Fig5 Comparison of sum rate variation forPU ZFBF and proposed system modelwith single relay and N=6 receivers

VIII. CONCLUSION

Multi user and Multi channel underlay system is considered withdistributed relay nodes and developed an iterative technique to minimize the total transmit power consumed by all source and relay nodes such that a minimum SINR threshold is maintained at each receiver. The proposed algorithm exploits beamforming techniques at the relay nodes and the destination nodes in conjunction with transmit power control in order to achieve the increased sum rate or throughput rate of the outage coverage area i.e. secondary user. Simulation results show that, it can obtain close-to-optimal solution with a price of high computation complexity. Moreover, beamforming with interference tolerance capability introduced by our system model can achieve better performance than traditional ZFBF. With the increased power budget, secondary users are favoured to have more individual power allocation and interference constraints are satisfied.

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