CONSTRUCTING A PRECODER FOR CHANNEL ISSUES IN MIMO UNDERLAY COGNITIVE RADIO NETWORK

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Abstract - *Inaccurate information of channel state data(CSI) limits the performance offered by MIMO communications. The design of a MIMO precoder ought to take the CSI uncertainty into thought to mitigate its effects. This paper proposes a method to style the precoder for a secondary user in associate degree underlay cognitive radio framework that maximizes its transmission performance, wherever the direct link to its receiver and the interference link to a primary user have CSI uncertainties. We model the CSI uncertainties through the Schatten norm that encompasses most typically used norm measures such as the spectral and Frobenious norms. The projected technique solves iteratively a minimax downside by account the optimum solution for the worst case interference CSI uncertainty, applying the alternate-iterate technique for the worst case direct link CSI deviation, and developing a possible direction projected subgradient technique for the precoder. easier solutions for the precoder are derived under some specific norm live of CSI uncertainty and sure demand of transmission power. Simulations corroborate the expected performance of the proposed style.*

Key Words: **Semilog, THETA, RHO, plot, rand, hist ,bar etc**

1. INTRODUCTION

The exploitation of multiple-input multiple-output (MIMO) techniques for increasing data throughput often depends on the quality of channel state information (CSI) available. A MIMO transmitter can utilize a precoder devised from the available CSI for sending signals over more favorable spatial directions to increase the spectral efficiency and ensure the quality of service (QoS) to the end users. In practice uncertainty appears in the acquired CSI, rendering the expected performance offered by MIMO. It is necessary to take the uncertainty of CSI into consideration when designing the precoder, to mitigate the damage it can cause.This paper considers an underlay cognitive radio (CR) point -to- point MIMO system in which a secondary user (SU) seeks communication in the presence of a primary user (PU) where its QoS should be assured. The available CSI of the direct link between SU-Transmit (SU-Tx) and SU-Receive (SU-Rx) and the interference link between SU-Tx and PU-Receive (PU-Rx) is not accurate.

The CSI error in the direct link is attributed to the short coherence time, limited feedback or significant demand of spectrum resources by PUs. The uncertainty in interference CSI results from the non-cooperative nature of PU with SU since both users often belong to different networks. The objective is to design a linear precoder for SU-Tx to improve the SU transmission performance that is robust to the CSI uncertainties, while ensuring the QoS for PU. The underlay CR paradigm is less demanding in managing interferences than some other approaches, such as interference alignment, which requires the availability of CSI for all link connections and a precoder at each transmitter and a combiner at each receiver ends. The uncertainty of CSI can be modelled in a stochastic or a deterministic manner. Under the stochastic model the robust design seeks a precoder that optimizes a stochastic performance metric with probabilistic constraints. The stochastic approach is usually not amenable in optimization because of the lack of closed-form expressions for the CSI probability distributions. The deterministic model uses a quantitative measure together with a compact set, whose size and shape are usually evaluated from field measurements, to encapsulate the CSI uncertainties.

1.1 Objective:

The exploitation of multiple-input multiple-output(MIMO) techniques for increasing data throughput often depends on quality of channel state information(CSI) available. Inaccurate knowledge of channel state information (CSI) limits the performance offered by MIMO communications. The design of a MIMO precoder should take the CSI uncertainty into consideration to mitigate its effects. Thereby increasing the secondary user rate and QOS of secondary user. Also we ensure the QOS of primary user during this process of increasing the transmission efficiency of secondary user in using underlay cognitive radio. Here the CC ,CR, Leakage are the most common channel problem that are taken into account and all are reduced. Thereby tracking the channel a safe path for transmission. Here the problem are faced by various norms and algorithms for easy to implementation to improve the efficiency from 40%-70%.

Our objective is to improve the transmission of the secondary user when the primary user is also active in transmission and to reduce the complexity during spectrum sharing and modify the data according to the channel parameters before sending it through the channel.

2. PROJECT DESCRIPTION

Cognitive radio is one the recent revolutionary advancement that promises to govern the future wireless word. The ultimate objective of cognitive radio is to use available spectrum efficiently in fair minded and cost effective manner and provide highly reliable communication for all users of the network, wherever and whenever needed. The motivation of the cognitive radio is a concept of reusing licensed spectrum in an unlicensed manner without causing interference. This feature of CR is very important in providing services to the users especially when they are mobile and the base stations in contact are constantly changing.

- Quality of service improvement-availability and reliablity of wireless services will improve user's point of view.
- Benefits to the service provider-because of increased information transfer rates more customers attracts towards the services.
- Future-proofed product-a CR is available to modify services, protocols, modulation, spectrum etc. without the need for a user or manufacturer to upgrading to device.
- Common hardware platform-manufacturers does not need to build several hardware variants, instead using a single common platform to run a wide range of software.
- Emergency communication services-at the time of major incidents joint operations would greatly beneficial to police, fire, ambulance could be linked together in one radio.
- Benefits to the license-in this licenses would be allowed to rent a portion of their spectrum rights to other parties and make money.

3. EXISTING SYSTEM:

There are several additional degree of freedom in MIMO channel than in SISO. The existing system deals with CSI uncertainity problem which are CR and CC problem. For the CC problem two methods were used,

1. Uniform power allocation

2. Beamforming on nominal (known) channel eigen mode.

In the first one the power is allocated uniformly based on the channel parameters obtained. The available transmit power is optimally allocated over the eigen values obtained by diagonalising the channel matrix in a water filling fashion. The robust solution is obtained from the maxmin function. In the second one the channel can attain maximum capacity by varying the values of eigen modes of nominal channel and selecting the strongest value that remains active for the transmission. For the CR problem, a precoder was designed to maintain the throughput of secondary user in underlay MIMO network. In this, for determining unknown CSI, iterative adaptation algorithm is used by exploiting the side information.

3.1 DISADVANTAGES OF EXISTING PAPER:

The first two methods focus on CC problem and not on other uncertainities. The second method is applicable only for known channel. The system does not seem robust as it sounds. By considering CR problem there is lack of co-ordination between primary user and secondary user.

4. RESULT:

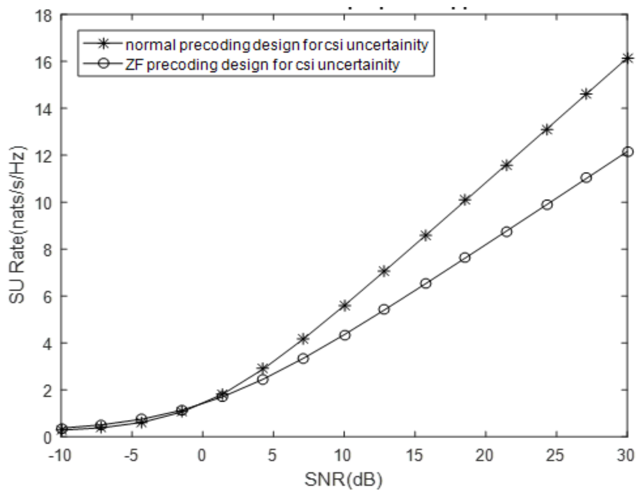

Fig -1: SNR(dB) Vs SU-Rate(nats/s/Hz)

This is the output we obtained from the project. The circle denotes the secondary user rate obtained using the iterative adaptive algorithm, whereas the star(*) denotes the secondary user rate obtained using the zero forcing algorithm. the secondary user rate obtained using the zero forcing algorithm is comparatively high than the rate obtained using iterative adaptation algorithm. This graph proves that the efficiency has increased.

5. CONCLUSION

We have developed in this paper the solution of a robust precoder for an SU in an underlay cognitive radio framework ,where the available CSI of the direct link of SU and the interference link to PU have uncertainties and the QoS of PU must be maintained. In the absence of PU, the proposed solution addresses the CC problem in the literature. The CSI uncertainities are modelled by convex sets with the Schatten norm measure. We formulate the design as a maximin optimization problem that seeks a precoder to maximize the rate of SU under the most conservative anticipated performance for SU while ensuring the QoS of PU under all possible CSI uncertainities expected in the interference link. The maximin problem is solved iteratively, using the explicit solution for the worst case CSI deviation of the interference link. Convergence analysis of the proposed solution is established. Simpler solutions for some specific choices of the norm measure and transmission power restrictions are also derived. Simulations validate the performance improvement of the proposed precoders for the CR and CC problems.

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