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Channel Aware Reconfigurable Mode Selection and Channel Estimation for Mu-Mimo System

R. Amutha ,Jayashree Prabu , G. Jeevitha , R. Lavanya, Mr. R. Anandan
UG student, Final year ECE Department , Dhanalakshmi srinivasan college of engineering and technology , Mamallapuram ,kancheepuram district .
UG student, Final year ECE Department, Dhanalakshmi srinivasan college of engineering and technology, Mamallapuram, kancheepuram district.
UG Student, Final year ECE Department, Dhanalakshmi srinivasan college of engineering and technology, Mamallapuram, kancheepuram district.
UG Student, Final year ECE Department,
Dhanalakshmi srinivasan college Of engineering and technology, Mamallapuram, kancheepuram Districrt.
Associate professor , Department of electronics and communication, Dhanalakshmi srinivasan college of engineering and technology, Mamallapuram, kancheepuram district.

Abstract: *To accomplish of cellular systems for 5G field emphatically . To investigate various antenna and diversity selection in MU- MIMO system with help of CSI framework. To maximize the efficiency of the system time domain pilot aided channel estimation technique are proposed for multiple users. To analyze the performance of this novel techniques for MU MIMO shows better utility compared to Other techniques.*

I. Introduction

Upcoming 4G broadband wireless communication systems. Motivated by the huge demands for fast and reliable communications over wireless channels, future broadband communication systems should provide swifter data processing (low-complexity), higher data rate, and stronger (robust) performance.

In practice, however, the broadband channel is a typically non-line-of-sight channel and includes impairments such as time selective and frequency-selective fading. To address these challenges, one promising solution is to combine two powerful technologies, namely, multiple-input multiple-output (MIMO) antennas and orthogonal frequency division multiplexing (OFDM) Modulation.

A space-time (ST) code is a bandwidth-efficient method that can improve the reliability of data transmission in MIMO systems. It encodes a data stream across different transmit antennas and time slots, so that multiple redundant copies of the data stream can be transmitted through independent fading channels.

MIMO can also be used in conjunction with OFDM, and is part of the IEEE 802.16 standard, and will also be part of the IEEE 802.11n high-throughput standard. The air-link architecture of MIMO-OFDM has also been suggested for the future 4G wireless systems.

II. Multiple Input Multiple Output

The MIMO concept, presented about ten years ago, was enthusiastically approved by the scientific community. MIMO systems provided the solution for overcoming the well known barriers in wireless communications: the limited spectral efficiency and the low quality of the transmission caused by the fading. While a compromise must be still agreed between these two limitations, the multiple antennas can boost

the system performance in both areas. Nowadays, when the need for mobile broadband multimedia networks is growing continuously, MIMO systems fill the important gap in the variety of wireless systems. The idea of MIMO turned out to be difficult to implement in wireless systems. Great performance is paid with the increased signal processing and power consumption both at the transmitter and the

receiver. Moreover, the precise channel knowledge is usually needed for the system to work properly. Despite the years of the research, many issues are still not clear and more efficient solutions are desired. The research in the whole MIMO area is still in progress.

Overview:

We first give a brief introduction of MIMO technology and with various modulations. We then focus on a general coded MIMO system and give two basic definitions, namely, the code rate and diversity gain. An overview of ST coding, SF coding, and STF coding employed in MIMO systems is given. We will extend the discussion to Multiuser MIMO and, in particular, we propose a new design of multiuser STBC MIMO coding. Finally, we draw our conclusion.

Wireless Data Applications:

Wireless communication is one of the most vibrant areas in the communication field today. The past decade has seen a surge of research activities in the area. This is due to a confluence of several factors. First, there has been an explosive increase in demand for tether less connectivity, driven so far mainly by cellular telephony but expected to be soon eclipsed by wireless data applications.Second, the dramatic progress in VLSI technology has enabled small-area and low power implementation of sophisticated signal processing algorithms and coding techniques.

The Adverse Wireless Channel:

Every wireless system has to combat transmission and propagation effects that are substantially more hostile than for a wired system. In the early days of wireless telegraphy, Marconi successfully demonstrated that wireless signals can cross the Atlantic and Pacific Oceans. Today, the role of radio has changed: we are not using radio technology merely to cover large distances, but rather for its flexibility and comfort.

Short-range wireless links provide access to the fixed telecommunication infrastructure. Critical technical bottlenecks in a wireless link are the capacity of the radio channel, its unreliability due to adverse time-varying, multipath propagation and severe interference from other transmissions, in neighbouring cells. Unless specific measures are taken, substantial fade margins are needed, in addition to the C/I or C/N protection ratio used in a stationary (non-varying) channel.

Applications Of Wireless Technology

- Security systems
- Television remote control
- Cellular telephone (phones and modems)
- Wi-Fi
- Wireless energy transfer
- Computer interface devices.

Full Channel State Information:

If the channel matrix is completely known, singular value decomposition (SVD) precoding is known to achieve the MIMO channel capacity. In this approach, the channel matrix is diagonalized by taking an SVD and removing the two unitary matrices through pre- and post-multiplication at the transmitter and receiver, respectively.

MIMO:

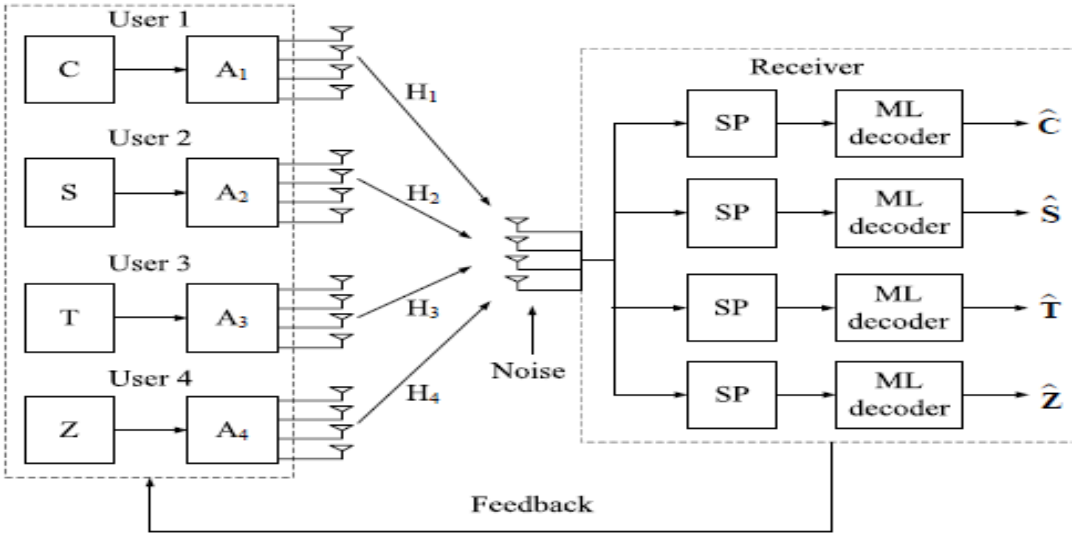
This is an antenna technology which uses multiple channels in radios to provide the functions of both the transmitter and receiver of data signals sent over the network. It provides high spectral efficiency and link reliability facilitating significant increase in the data throughput and radio link usage without additional bandwidth and transmission power. This high efficiency is due to the availability of an independent path in a rich scattering environment for each transmitter and receiver antennas in the radio.

The MIMO channels can be used with OFDMA for transmission and reception of modulated signal over network to single or multiple users. This is currently used in WLAN – Wi-Fi 802.11n, Mesh Networks (e.g., WMAN– WiMAX 802.16e, RFID, and Digital Home).

Multiuser Mimo Channels:

In cellular or wireless local area networks, there are many users who need an access to the radio channel at the same time. Thus, multiple access techniques, like TDMA, FDMA and CDMA (time, frequency and code division multiple access), are developed. The systems with multiple antennas allow the multiple access also in the space dimension. In a radio network, there are many mobile terminals communicating with the base station or the access point.

It is usually expected that the base station can be equipped with multiple antennas, while the mobile terminals are rather single antenna devices. It is caused by many factors. First, the mobile terminals should be cheap and have low complexity. Second, it is more realistic to exchange or rebuild some base stations to boost the network performance in a chosen region than press users to buy new terminals. Finally, the size of the mobile station can be too small to mount the multiple antennas with the required separation.



Application Of Mimo:

MIMO is also planned to be used in Mobile radio telephone standards such as recent 3GPP and 3GPP2 standards. In 3GPP, High-Speed Packet Access plus (HSPA+) and Long Term Evolution (LTE) standards take MIMO into account. Moreover, to fully support cellular environments MIMO research consortia including IST-MASCOT propose to develop advanced MIMO techniques, i.e., multi-user MIMO (MU-MIMO).

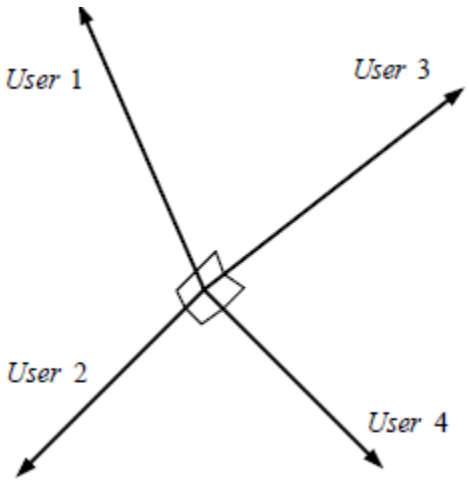


Fig. 2. Orthogonal structure of signal vectors in 4-dimensional space

III. Proposed Method

To carry out pilot aided correlation based channel estimation for accurate prediction of channel state.
To prove the merits of accurate CSI at receiver side over high mobility channels.

IV. Channel Estimation Vs Pn Sequence

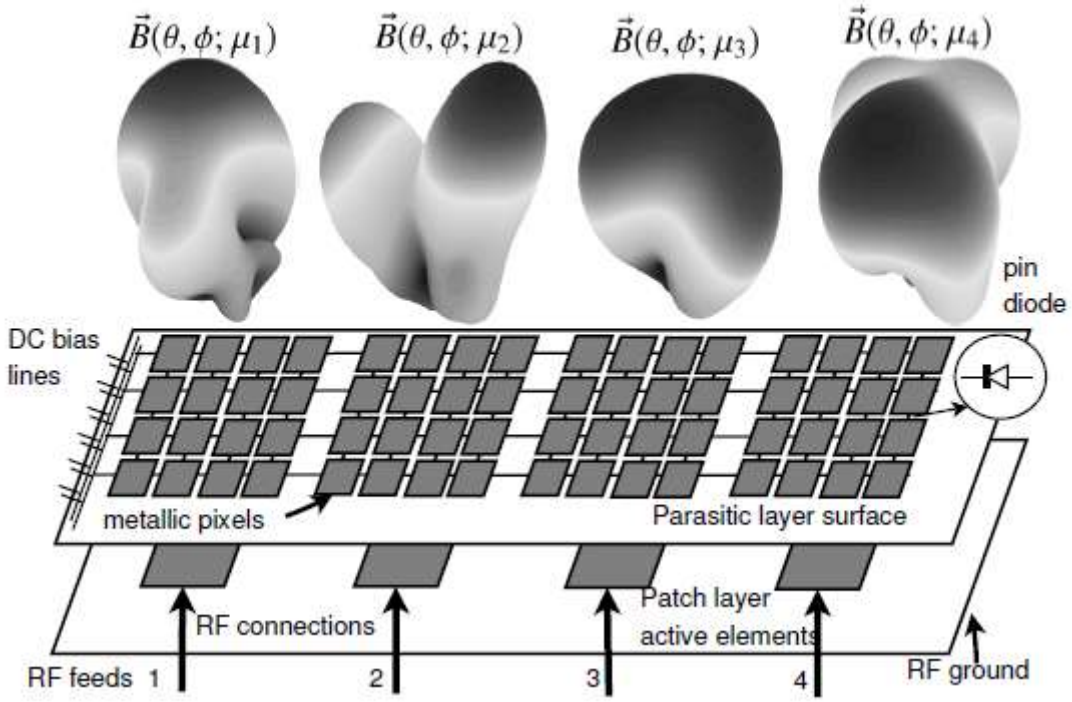
In order to get channel frequency responses (flat fading or non selective) some pair of PN sequence called pilot information is transmitted along with user encoded data.
Here pilots are TX in time domain rather than in separate adjacent subcarriers(frequency domain) before MIMO encoding process.

Advantages:

- Channel estimation error will be reduced.
- Efficiency will be improved.

Applications:

- IPTV(Internet Protocol TV)
- DVB(Digital Video Broadcasting)
- Online Gaming
- DTVB(Digital Terrestial Video Broad casting)



V. Conlusions

A downlink MU-MIMO communication system utilizing radiation pattern reconfigurable antennas (RAs) is presented. While legacy MU-MIMO schemes rely on the multi-user diversity, the proposed system can utilize both user diversity and antenna pattern diversity. Using the parasitic tuning approach along with multi-objective genetic algorithm (GA), RAs with radiation patterns suitable for typical MU-MIMO transmission scenarios are developed. To reduce the channel estimation overhead, we develop two active mode-set generation algorithms that can select a small subset of radiation pattern modes using the knowledge of (1) pattern-covariance or (2) channel covariance. We also develop mode selection techniques that can efficiently utilize the modes within the active mode-set and improve the MU-MIMO transmission. In particular, the proposed iterative mode selection schemes can reduce the mode selection complexity significantly while performing very close to the exhaustive search based schemes. The joint user and mode selection scheme can utilize both user diversity and pattern diversity at the same time with relatively small additional complexity. The proposed technique is capable of creating channel conditions with significantly improved MUMIMO capability for any given user-tuple, and thereby, can reduce the burden on the user scheduling procedures that are typically NP-hard problems. Numerical examples with 2 and 4 transmit antenna systems indicate 6 − 17 dB performance improvements for the SERs with various schemes developed in this work. The sum-rate performance for M = 4 antenna case indicates that the RA system can handle 4 users much more effectively (more than 8 times throughput) as compared to the legacy system with non- reconfigurable antennas.