ADAPTIVE BLIND INTERFERENCE CANCELLATION AND SPATIAL SCHEDULING SCHEMES FOR CLOSED LOOP MULTIUSER MIMO SYSTEMS

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***Abstract*– To improve the spectrum efficiency in wireless communication, two techniques are commonly used: adaptive digital signal processing and resource allocation. The aim of both techniques is to reduce the interference level. In this paper we study the performance improvement of using jointly these techniques for closed loop multiuser MIMO systems. We propose a closed loop spatial multiuser scheduling scheme that enables code-reuse without significantly degrading the performance of an Adaptive Blind Receiver (ABR).**

***Keywords*– Blind, MIMO, Interference, Schedule.**

I. INTRODUCTION

Closed loop transmit diversity (CL-TD) technique, applied on MIMO broadcasting channel, improves the system capacity in both, the single user scenario and the multiuser case (Caire and Shamai, 2003). However, in order to improve the spectrum efficiency of practical schemes while keeping small performance degradation, it is necessary a joint signal processing at both side of the radio link.

At the receiver, several algorithms have been proposed with the aim to reduce the interference level efficiently (Wrulich *et al.,* 2008; Mehlfuhrer *et al*., 2008). On MIMO channels, the use of low complexity receivers that improve the performance of conventional scheme (that treats interference as white Gaussian noise), is of fundamental importance (Lupas and Verdu, 1990). In particular, blind adaptive receiver results attractive for high data rate packet communication because on such dynamic environment is difficult for a mobile user to get precise information about the rest of active users. Closed loop multiuser MIMO is a promising technique for achieving high spectrum efficiency needed for the higher data rate of future wireless system. The standard WCDMA 3GPP (2006); Hottinen *et al*. (2003) allocates a limited feedback channel that can be used for sending back to the Base Station information about the channel back to the Base Station (BS). This information is used to support two closed loop transmit diversity modes, and can also enable spatial multiplexing techniques that increase the system´s capacity and potentially simplify the receiver architecture (Haikola *et al*., 2006).

Due to practical considerations, the most widely analyzed scenery for the down link broadcast channel considers a BS equipped with two antennas and single-antenna mobile users (Love *et al.,* 2008). Schemes that schedule multiple users prefiltering them at the transmission by a matriz with channel information weights reported by these users, have been extensively studied in terms of capacity gain (Corral-Briones *et al.*, 2005; Dowhuszko *et al*., 2007; Shenoy *et al*., 2009). Although achievable system capacity is important to study, the potential of those schemes does not give practical information about the type of transceiver that enable high spectrum efficiency with affordable complexity.

In this paper we analyze the performance in terms of Bit Error Rate (BER) of different user scheduling methods that use space signal processing at the BS (to reduce interference) and adaptive blind interference cancellation at the mobilw stations. A new spatial Multiuser Scheduler (MS) is proposed based on the observation that a blind detector cancels the interference that belongs to a subspace orthogonal to the desired signal. The proposed scheme enables code-reuse doubling the number of users that can coexist without significant performance degradation. The results presented are for WCDMA closed loop transmit diversity mode 1 (Yoo *et al.*, 2007).

The following notation is used in the paper. $\Re$, C, $(.)^*$, $(.)^T$, $(.)^H$, <.>, ||.||, denote real part, complex number, complex conjugate, transpose, hermitian, correlation and norm, respectively. Scalars are written in lowercase, vectors in bold lowercase and matrices with bold uppercase letters. The system model is presented in Section II. Adaptive blind receiver is analyzed in Section III, followed by scheduling schemes presented in Section IV. Simulation results are presented in Section V, followed by paper conclusions.

II. SYSTEM MODEL

The system model for the downlink of a wireless communication system is illustrated in Fig. 1. The system consist of a single BS with 2 Tx antennas j=1, 2 and $K\geq 2$ active user equipments (*UEs*) with single-elements antennas.

In case of flat fading and rich scattering, the channel gain from a j^{th} Tx antenna to a k^{th} User (UE) is described by a *zero-mean circularly symmetric complex Gausssian Random Variable* (RV) g_{jk}, for j=1,2 and k=1,…,K. For simplicity we assume that all UE's are homogeneous and experience independent fading. We also assume that each UE has a low-rate, reliable, and delay-free feedback channel to the BS.