

A Space-Time Chip Semiblind Multiuser Receiver Based on LMS Algorithms

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Abstract—A low complexity space-time chip semiblind multiuser receiver based upon an adaptive mixing parameter and adaptive step-size for MIMO STBC downlink MC-CDMA with CPICH systems and without CP is proposed. The receiver exploits information from training and desired user signals for updated the algorithm. Information from training and blind modes are combined using an adaptive mixing parameter LMS algorithm. The AS-LMS algorithm is incorporated in a semiblind, which in turn improves the performance of the receiver in frequency-selective fading channel. The detection requires only the knowledge of the desired user code matrix. The simulation results show that the mixing parameter adapts depending on the number of activated users in the system. As a result the performance of the proposed semiblind receiver outperforms in the SINR existing space-time chip semiblind and training-based receivers in dynamic channels.

Keywords: Semiblind, Adaptive mixing parameter, STBC, MC-CDMA, AS-LMS.

I. INTRODUCTION

Multi-carrier code division multiple access (MC-CDMA) scheme is a promising technique for relative capacity limitation problem of direct-sequence CDMA systems [1]. MC-CDMA lends itself as is a multiplexing technique which combines orthogonal frequency division multiplex (OFDM) with DS-CDMA, hence better utilise the spectrum and meet the demand of wireless mobile multimedia services. It is being considered as a potential candidate for the fourth generation (4G) mobile radio technology [2].

For MC-CDMA systems operating in frequency-selective fading channels, a usual approach for combating the resultant hostile ISI is via addition of cyclic prefix (CP) to each transmitted data block. The length CP must exceed the length of the channel impulse response. By using CP, the spectral and power efficiencies are significantly reduced along with increasing of CP length [3]. Another solution is to utilise a time domain equaliser (TEQ) with the effective channel shorten to less than the CP length. But those techniques are not effective for the fast time varying wireless channel [4]. To maintain the spectral efficiency, it is meaningful to focus on MC-CDMA without CP. However, by not using CP, ISI and MAI are clearly inevitable.

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Some advanced signal-processing techniques are available to mitigate interference and multipath distortion. They are largely categorised into space-time processing with antenna array. Multiple input multiple output (MIMO) communication systems inherit space diversity to mitigate fading effects. When the channel is not known at the transmitter, taking advantage of the transmit diversity requires methods such as space-time coding which uses coding across antennas and time. Alamouti scheme [5] provides full spatial diversity gain, low complexity and can be considered as a very realistic. It has been proposed as a standard for 3G wideband CDMA and is a promising candidate for air interface downlink of the next generation mobile radio systems [6].

A technique [7] has recently been developed for space-time block-coded (STBC) signalling over frequency-selective fading channels in the maximum multi-antenna diversity, maximum multipath diversity and multiuser communication that overcome the limitation of the original STBC scheme [5] in being operated only in flat fading channels. In addition, the methodology of employing STBC in training-based and semiblind chip equalisations for the common pilot channel (CPICH) systems are also proposed in [7] and [8]. However, those algorithms require inverse block matrix for updating the space-time chip equalisers and knowledge of the spreading codes of all users existing in the system.

Recently, blind time-domain multiuser detection for MC-CDMA systems without CP, semiblind space-time frequency multiuser receiver and semiblind channel estimation are proposed in [9-11], respectively. Blind algorithm appears more attractive since the cumbersome reliance on training information is avoided. Semiblind algorithm which incorporates information from both known and unknown symbols that is considered, as a result of its performance is superior than the schemes using training based or blind based only [12]. However, those algorithms are based on signal subspace estimation. For long-code MC-CDMA systems, subspace method cannot be directly applied since cyclostationarity at the symbol is no longer available and Singular Value Decomposition (SVD) is employed for signal subspace tracking to increase the computational complexity. Especially, those algorithms are not designed to support the systems with CPICH.

In this paper, we propose a space-time chip semiblind multiuser receiver based on adaptive mixing parameter and adaptive step-size least mean square (AS-LMS) for

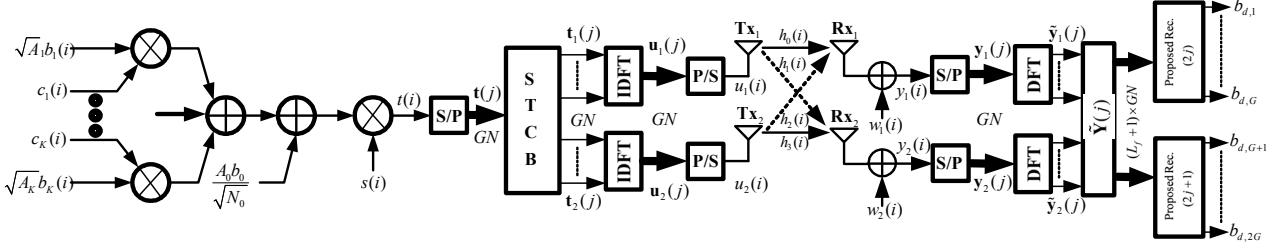


Figure 1. The MIMO STBC downlink MC-CDMA with CPICH system and without CP model.

STBC downlink MC-CDMA with CPICH systems and without CP. The received cost function incorporates information from blind mode and training mode. Combination between two modes is achieved by the adaptive mixing parameter. The AS-LMS is incorporated in a semiblind updated function, which in turn improves the performance of the receiver in dynamic channel. Computer simulation results show that the proposed semiblind receiver outperforms existing semiblind [7-8] and training based [7] receivers in the signal to interference plus noise ratio (SINR) in frequency-selective fading channel where the number of user in the system abrupt change.

II. SIGNAL MODEL

Let us consider a baseband model for MIMO downlink STBC MC-CDMA with CPICH system and without CP based on Alamouti's STBC, which is illustrated in Fig.1. For conciseness, we will focus on a base-station with two transmitted antennas and a mobile with two received antennas, where base station has K symbol-synchronous users. The k^{th} mobile user is assigned an orthogonal code of length N , with the all-one code reserved for CPICH of forthcoming 3G systems. Following this, signals from all users including the pilot is combined and multiplied by a cell-specific long-code sequence. A synchronous code division multiplexed signal $t(i)$ is given by

$$t(i) = s(i) \left(\sum_{k=1}^K \sum_{m=1}^M \sqrt{A_k} c_k(i-mN) b_k(m) + \sqrt{A_0} \frac{b_0}{\sqrt{N_0}} \right), \quad (1)$$

where A_k is the power for the k^{th} user, A_0 is the power of pilot signal, $s(i)$ is the base-station long scrambling code, $c_k(i)$ is the short spreading code of length N and i is chip sequence. $b_k(m)$ is the data symbol for the k^{th} user with window size of M bits and b_0 is the pilot signal with spreading gain N . The synchronous code division multiplexed signal chip sequence $t(i)$ is series-to-parallel (S/P) converted into the $1 \times GN$ multiuser chip block sequence $\mathbf{t}(j)$:

$$\mathbf{t}(j) = [t(jGN+1), \dots, t((j+1)GN)], \quad (2)$$

where G is block size and j is block sequence. After the multiuser chip block sequence $\mathbf{t}(j)$ is transformed to space-time block encoding technique [6]

$$\begin{bmatrix} \mathbf{t}_1(2j) & \mathbf{t}_1(2j+1) \\ \mathbf{t}_2(2j) & \mathbf{t}_2(2j+1) \end{bmatrix} \quad (3)$$

where $\mathbf{t}_1(2j)$ and $\mathbf{t}_2(2j)$ block sequences have the length $1 \times GN$

$$\begin{aligned} \mathbf{t}_1(2j) &= [t(2jGN+1), \dots, t(2jGN+GN)], \\ \mathbf{t}_2(2j) &= [t(2jGN+GN+1), \dots, t(2(j+1)GN)], \end{aligned} \quad (4)$$

and

$$\begin{aligned} \mathbf{t}_1(2j+1) &= -\mathbf{t}_2^*(2j)\mathbf{P}_{GN}, \\ \mathbf{t}_2(2j+1) &= \mathbf{t}_1^*(2j)\mathbf{P}_{GN}, \end{aligned} \quad (5)$$

where \mathbf{P}_{GN} is a $GN \times GN$ permutation matrix. The space-time block encoding $\mathbf{t}_{M_T}(j)$ at block sequence $(2j)$ and $(2j+1)$ are loaded into the OFDM modulator, where the OFDM modulation is implemented using inverse discrete Fourier transform (IDFT). Thus the OFDM modulated signal block sequence $\mathbf{u}_{M_T}(j)$ is given by

$$\mathbf{u}_{M_T}(j) = \text{IDFT}(\mathbf{t}_{M_T}(j)), \quad (6)$$

where $M_T = 1, 2$ is the number of transmitted antenna. Finally, the $\mathbf{u}_{M_T}(j)$ signal block sequence is parallel-to-series (P/S) converted to the chip signal sequence $u_{M_T}(i)$ and is transmitted by the M_T transmitted antenna with chip rate T_c .

In practice, the signal reaching each mobile passes through a multipath frequency-selective fading channel. Here, we consider an FIR channel model with the channel impulse response $h(i)$, $i \in \{0, \dots, L_h\}$, where the L_h is order of channel. In MIMO downlink, the users in the same base-station are synchronous and go through the same channel. Therefore, at the mobile station, the chip received signal $y_{M_R}(i)$ at M_R received antenna is then the convolutional result of the transmitted signal $u_{M_T}(i)$ and the channel impulse response $h_{M_T, M_R}(i)$ and is corrupted with Additive White Gaussian Noise (AWGN) $w_{M_R}(i)$. After the chip received signal at antenna one and antenna two are S/P converted into the $1 \times GN$ chip block sequence $\mathbf{y}_{M_R}(j)$. They are demodulated by OFDM demodulator $\tilde{\mathbf{y}}_{M_R}(j)$, where demodulation is implemented using discrete Fourier transform (DFT).

$$\mathbf{y}_{M_R}(j) = [y_{M_R}(jGN+1), \dots, y_{M_R}(jGN+GN)],$$

$$\tilde{\mathbf{y}}_{M_R}(j) = \text{DFT}(\mathbf{y}_{M_R}(j)). \quad (7)$$

The space-time demodulated signal $\tilde{\mathbf{y}}_1(j)$ and $\tilde{\mathbf{y}}_2(j)$ are transformed to block sequence $(2j)$ and $(2j+1)$ as

$$\begin{aligned}\tilde{\mathbf{y}}_{M_R}(2j) &= [\tilde{y}_{M_R}(2jGN+1), \dots, \tilde{y}_{M_R}(2jGN+GN)] \\ \tilde{\mathbf{y}}_{M_R}(2j+1) &= [\tilde{y}_{M_R}(2jGN+GN+1), \dots, \tilde{y}_{M_R}(2(j+1)GN)] \mathbf{P}_{GN}\end{aligned}\quad (8)$$

Hence, the chip received space-time block decoding sequence $\tilde{\mathbf{Y}}(j)$ is formulated by the shift matrix from $\tilde{\mathbf{y}}_{M_R}(2j)$ and $\tilde{\mathbf{y}}_{M_R}(2j+1)$ as

$$\tilde{\mathbf{Y}}(j) = \begin{bmatrix} \tilde{y}_1(2jGN+1) & \dots & \tilde{y}_1(2jGN+GN) \\ \tilde{y}_2(2jGN+1) & \dots & \tilde{y}_2(2jGN+GN) \\ \vdots & \vdots & \vdots \\ \tilde{y}_1\left(2jGN+GN+\left(\lceil L_f/4 \rceil+1\right)\right) & \dots & \tilde{y}_1\left(2(j+1)GN+\left(\lceil L_f/4 \rceil+1\right)\right) \\ \tilde{y}_2\left(2jGN+GN+\left(\lceil L_f/4 \rceil+1\right)\right) & \dots & \tilde{y}_2\left(2(j+1)GN+\left(\lceil L_f/4 \rceil+1\right)\right) \end{bmatrix}, \quad (9)$$

III. THE PROPOSED SPACE-TIME SEMIBLIND RECEIVERS

In this section, criterian to obtain linear time domain space-time chip semiblind multiuser receiver based on adaptive mixing parameter LMS and AS-LMS algorithms are consideration. The receiver distinctly exploits advantage of information from training-based mode and blind mode for updated algorithm. The combination between two modes is achieved by an adaptive mixing parameter. The updated at j^{th} block sequence of the receiver requires only the knowledge of even $\mathbf{C}_d(2j+1)$ and odd $\mathbf{C}_d(2j)$ desired user code matrices.

To formulate the algorithm, let us defined a mean square error (MSE) cost function as

$$J(\mathbf{f}, \phi) = E\left\{\phi(j)\|\mathbf{e}_d(j)\|_{\text{blind}}^2 + (1-\phi(j))\|\mathbf{e}_p(j)\|_{\text{training-based}}^2\right\}, \quad (10)$$

where

$$\mathbf{e}_d(j) = (\mathbf{f}^H(j)\mathbf{Y}(j)\mathbf{C}_d^H(j) - \hat{\mathbf{b}}_d(j)), \quad \mathbf{e}_p(j) = (\mathbf{f}^H(j)\mathbf{Y}(j)\mathbf{C}_p^H(j) - \mathbf{b}_p(j))$$

where $\mathbf{f}(j) = [f_{j,0}, \dots, f_{j,L_f}]^T$ is a coefficient vector of the equaliser at block sequence j^{th} , $\phi(j)$ is mixing parameter, $\mathbf{b}_p(j) = \mathbf{1}_{1 \times G}$ is the pilot data symbol block sequence, $\hat{\mathbf{b}}_d(j) = [b_1(j), \dots, b_G(j)]$ is the data symbol block sequence of desired user from a hard decision output of hard limiter ($\hat{\mathbf{b}}_d(j) = \text{sgn}(\mathbf{f}(j)\mathbf{Y}(j)\mathbf{C}_d^H(j))$), $\mathbf{C}_d(j)$ is the desired user code matrix and $\mathbf{C}_p(j)$ is the pilot code matrix. The $\mathbf{C}_p(j)$ and $\mathbf{C}_d(j)$ code matrices are defined as

$$\mathbf{C}_k(j) = \begin{bmatrix} \mathbf{c}_k(jG) & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \ddots & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{c}_k((j+1)G-1) \end{bmatrix},$$

where

$$\mathbf{c}_k(n) = [c_k(nN) \times s(nN), \dots, c_k(nN+N-1) \times s(nN+N-1)].$$

The time domain space-time chip equaliser is employed to counter the effective multipath in frequency-selective fading channel, restores the orthogonality of the users' signal and suppresses MAI. A standard stochastic gradient descent (SGD) algorithm is employed for the adaptation of the equalisation tap. Based on the MSE cost, adaptation for the space-time chip equaliser tap vector $\mathbf{f}(j)$ at j^{th} block sequence using LMS based on adaptive step-size and adaptive mixing parameter is obtained as

$$\mathbf{f}(j+1) = \mathbf{f}(j) - \mu(j) \begin{pmatrix} \phi(j)\mathbf{e}_d(j)\mathbf{C}_d(j)\mathbf{Y}^H(j) \\ +(1-\phi(j))\mathbf{e}_p(j)\mathbf{C}_p(j)\mathbf{Y}^H(j) \end{pmatrix}^T. \quad (11)$$

However, the performance of the receiver heavily depends upon a choice of step-size. Therefore, the AS-LMS is incorporated in a semiblind updated function, which in turn improves the performance of the receiver in dynamic channel where the number of interferences in the system is time-varying [13]. For conciseness, the AS-LMS space-time chip equaliser even $\mathbf{f}(2j+1)$ and odd $\mathbf{f}(2j)$ parts are represented by $\mathbf{f}(j)$. Subsequently, the adaptive step-size LMS scheme at each recursion j , $\mu(j)$ is updated using the gradient obtained by minimising the MSE cost $J(\mathbf{f}, \phi)$ with respect to the step-size μ , $\frac{\partial J(\mathbf{f}, \phi)}{\partial \mu} \Big|_{\mu=\mu(j)}$.

$$\mu(j+1) = \left[\mu(j) - \alpha \begin{pmatrix} \phi(j)\mathbf{e}_d(j)\mathbf{C}_d(j)\mathbf{Y}^H(j) \\ +(1-\phi(j))\mathbf{e}_p(j)\mathbf{C}_p(j)\mathbf{Y}^H(j) \end{pmatrix} \mathbf{q}(j) \right]_{\mu^-}^{\mu^+}. \quad (12)$$

where α denotes the adaptation parameter for adaptive step-size part and $[\bullet]_{\mu^-}^{\mu^+}$ is truncation to lower and upper step-size limits. The derivative $\mathbf{q}(j+1)$ represents $\frac{\partial \mathbf{q}}{\partial \mu} \Big|_{\mu=\mu(j)}$ and is adapted according to

$$\begin{aligned}\mathbf{q}(j+1) &= \left\{ \mathbf{I} - \mu(j) \begin{pmatrix} \phi(j)\mathbf{Y}(j)\mathbf{C}_d^H(j)\mathbf{C}_d(j)\mathbf{Y}^H(j) \\ +(1-\phi(j))\mathbf{Y}(j)\mathbf{C}_p^H(j)\mathbf{C}_p(j)\mathbf{Y}^H(j) \end{pmatrix} \right\} \mathbf{q}(j) \\ &\quad - (\phi(n)\mathbf{Y}(j)\mathbf{C}_d^H(j)\mathbf{e}_d^H(j) + (1-\phi(j))\mathbf{Y}(j)\mathbf{C}_p^H(j)\mathbf{e}_p^H(j))\end{aligned}\quad (13)$$

The mixing ratio of information from blind mode and training-based mode are automatically adapted by adaptive mixing parameter part, in which depends upon the number of existing user in the system, see in simulation section. The adaptive mixing parameter LMS at each recursion j , $\phi(j)$, is updated in order to minimise the $J(\mathbf{f}, \phi)$ with respect to ϕ , $\frac{\partial J(\mathbf{f}, \phi)}{\partial \phi} \Big|_{\phi=\phi(j)}$.

$$\phi(j+1) = \left[\phi(j) - \beta \begin{pmatrix} \mathbf{e}_d(j)\mathbf{e}_d^H(j) - \mathbf{e}_p(j)\mathbf{e}_p^H(j) \\ \left(\begin{array}{l} \phi(j)\mathbf{e}_d(j)\mathbf{C}_d(j)\mathbf{Y}^H(j) \\ + (-\phi(j)\mathbf{e}_p(j)\mathbf{C}_p(j)\mathbf{Y}^H(j)) \end{array} \right) \Psi(j) \end{pmatrix} \right]_{\phi^-}^{\phi^+}, \quad (14)$$

where β denotes the adaptation parameter for adaptive mixing parameter part and $[\bullet]_{\phi^-}^{\phi^+}$ is truncation to

lower and upper mixing parameter limits. The derivative $\Psi(j+1)$ represents by $\frac{\partial \mathbf{f}}{\partial \phi}|_{\phi=\phi(j)}$, is updated as:

$$\Psi(j+1) = \begin{pmatrix} \mathbf{I} + \mu(j) \begin{pmatrix} \phi(j)\mathbf{Y}(j)\mathbf{C}_d^H(j)\mathbf{C}_d(j)\mathbf{Y}^H(j) \\ +\phi(j)\mathbf{Y}(j)\mathbf{C}_p^H(j)\mathbf{C}_p(j)\mathbf{Y}^H(j) \\ +\mathbf{Y}(j)\mathbf{C}_p^H(j)\mathbf{C}_p(j)\mathbf{Y}^H(j) \end{pmatrix} \\ -\mu(j) \begin{pmatrix} \mathbf{Y}(j)\mathbf{C}_d^H(j)\mathbf{e}_d^H(j) \\ -\mathbf{Y}(j)\mathbf{C}_p^H(j)\mathbf{e}_p^H(j) \end{pmatrix} \end{pmatrix} \Psi(j). \quad (15)$$

Finally, the G data symbol of desired user at j^{th} block sequence can be directly detected from:

$$\mathbf{b}_d(2j) = \mathbf{f}^H(2j)\tilde{\mathbf{Y}}(j)\mathbf{C}_d^H(2j), \quad \mathbf{b}_d(2j+1) = \mathbf{f}^H(2j+1)\tilde{\mathbf{Y}}(j)\mathbf{C}_d^H(2j+1). \quad (16)$$

The proposed algorithm involves three LMS algorithms: 1) for adapting the tap-weight vector 2) AS-LMS and 3) adaptive mixing parameter (AMP) LMS. For G symbol estimations through Eq. (10)-(15), see in table 1, the proposed algorithm possesses the total complex multiplication (CM) of order $O(L_fNG/2)$ whereas those of training-based receiver [7] and semiblind receivers [7-8] are of order $O(L_fNG/2)^2$, which complexities increase from inverse block matrix terms. Therefore, the training-based and semiblind receivers are two-fold increase in the total CM as compared to the proposed semiblind receiver.

IV. SIMULATION RESULTS

We considered the system without cyclic prefix which is based on a sampling frequency 57.6 MHz with a carrier frequency of 5 GHz and the subcarriers of 512. Walsh-Hadamard code is employed as the user-specific short code which has the length $N=32$ and a random code is used for the cell-specific long-code. A link level MIMO channel model which has been specifically developed within the Multi Element Transmit Receive Antennas (METRA) Model for Mobile Broadband Wireless Access System (MBWA) MIMO channel project [14] is used. This channel model is based on 3GPP/3GPP2 proposal [15] for mobile broadband wireless MIMO channel exploiting multipath angular characteristics.

In simulation, MIMO radio channels are inserted between parallel-to-series and series-to-parallel converters of MIMO STBC downlink MC-CDMA system model. Besides, the correlation properties in the spatial domain of broadband wireless MIMO channel are obtained from the Kronecker product of two independent correlation matrices, which is defined by the correlation properties at the BS and MS and the associated Doppler spectrum of channel part. The Case B ITU Pedestrian A MIMO channel parameters with 0.5λ antenna spacing, uniform power azimuth spectrum (PAS) and angle of arrival (AOA) 22 degree [14] is considered.

The performance of the proposed receiver was investigated in comparison with the training-based [7] and semiblind with fixed mixing parameter $\phi_{\text{opt}}=0.1$ [8], semiblind [7] and MMSE [16] receivers in MIMO STBC downlink MC-CDMA with CPICH system and without CP under frequency-selective fading channels, which was

TABLE I
SUMMARY CM OF THE PROPOSED SEMIBLIND ALGORITHM

Algorithm	Formulation	CMs
	$\mathbf{e}_d(j), \mathbf{e}_p(j)$	$2NG(L_f+G)$
Updated Equaliser	Eq. (11)	$2NG(L_f+G)$
AS-LMS	Eq. (12) Eq. (13)	$2NG(L_f+G)+2L_f$ $2(L_f)^2+2NG(L_f+G)+2L_f G$
AMP-LMS	Eq. (14) Eq. (15)	$2G+3NG(L_f+G)+L_f$ $3(L_f)^2+2NG(L_f+G)+2L_f G$

based on 3GPP2 modified Pedestrian A channel model with speed of 120km/h. Furthermore, the base station transmits QPSK symbol and all users has the same powers. The transmitted power at antenna 1 and antenna 2 are normalised to one. The additive noise is white Gaussian noise with SNR=10dB and without loss of generality.

The proposed receiver assumed only the known desired user code matrix and was updated using LMS algorithms. The training-based [7], semiblind receivers [7-8] assumed the known all user code matrices and were updated using least square (LS) methods with inverse block matrix terms. The MMSE receiver assumed perfectly the knowledge of channel impulse response and power of noise. We assumed throughout this section that user $k=1$ is the desired user. An initial step-size μ_0 for the proposed algorithm was chosen $\mu_0=1\times 10^{-2}$. The upper and lower step-size limits μ^+ and μ^- were 0.5 and 0, respectively. Also, the adaptation factors α of 1×10^{-4} and β of 1×10^{-4} were selected to provide performance near the optimum and maintained stability. The initial mixing parameter ϕ_0 for the proposed algorithm was chosen as $\phi_0=0.15$ and the upper and lower mixing parameter limits ϕ^+ and ϕ^- were 1 and 0, respectively. All receivers used the same order of equaliser $L_f=31$ and had block size $G=16$ symbols.

The simulation compares tracking capability of each receiver in detection of the desired user in a dynamic environment where the number of users in the system is time varying. At number of block $j=0$, pilot signal ($k=0$), desired user ($k=1$) and 13 interference users ($k=2,\dots,14$) activated in the system. At time $j=121$, 17 interferences users ($k=15,\dots,31$) entered the system. At $j=241$, apart from twenty-eight interference users exited the systems leaving two interferences, the pilot signal and desired user still existing in the system. Fig 6(a) illustrates averaged SINR over 50 Monte-Carlo runs. The semiblind based on mixing parameter and AS-LMS receiver responses to the abrupt change the number of users and offers the SINR improvement of approximately one and two dB in detection of desired user over space-time chip training-based [7] and space-time chip semiblind [7-8] receivers in the case of weak-loaded user. Fig (b) shows the averaged of the step-size and adaptive mixing parameter of the proposed semiblind algorithm. For the suddenly change, the trajectories of the step-size and the mixing parameter adapt to the steady state values as a result the receiver incorporates both of an adaptive mixing parameter LMS and AS-LMS algorithms. Furthermore, we find that the mixing parameter adapts depending on the number of

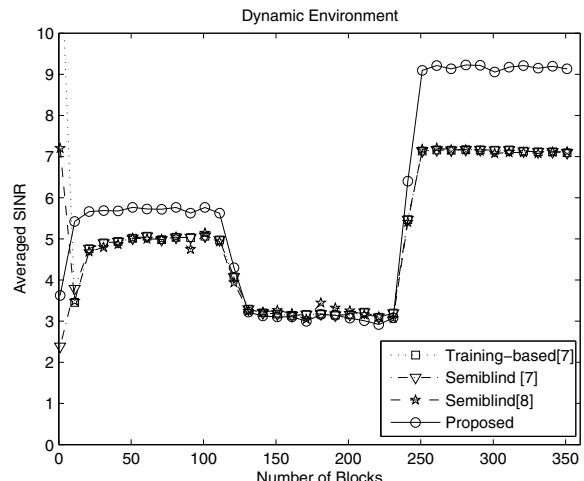
activated users in the system. Considering for weak-loaded case, the mixing parameter adapts to use more information from blind mode. Therefore, the proposed semiblind receiver mitigates the problem of SINR drop resulted by the use of shared equaliser as found in [17]. In the worst case (full-loaded), the proposed receiver performance converges to that of existing training-based receiver.

V. CONCLUSIONS

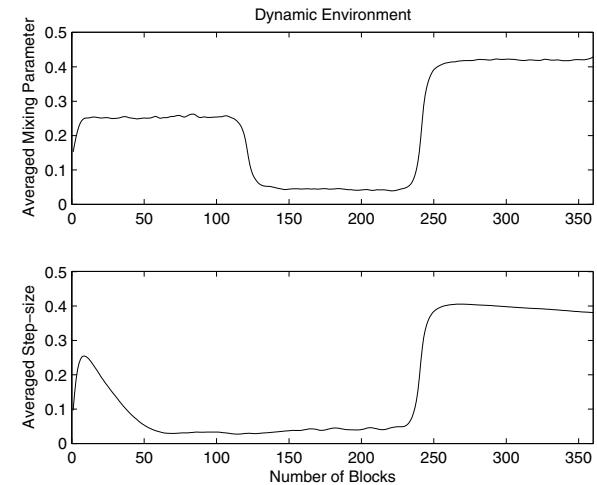
A low complexity time domain space-time chip semiblind multiuser receiver based on an adaptive mixing parameter LMS and AS-LMS has been proposed for STBC downlink MC-CDMA with CPICH systems and without cyclic prefix. The cost function of the receiver is based on exploiting information from training-based mode and efficiency from blind mode. A combination between two modes is achieved by an adaptive mixing parameter LMS algorithm. The AS-LMS algorithm is incorporated in the receiver to improve the performance in dynamic channel. The simulations were performed in a 3GPP2 MIMO frequency-selective fading channel model where the number of user in the system changes abruptly. It reveals that the proposed semiblind has an improvement in the SINR over existing space-time chip semiblind and chip training-based receivers in dynamic environment channel. As a result the mixing parameter adapts to mix information from blind and training-based modes that depends upon the number of activated users in the system.

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(a)



(b)

Figure 2(a) Averaged SINR's obtained from the proposed semiblind, training based [7], semiblind [7] and semiblind [8] receivers and (b) averaged mixing parameter and averaged step-size trajectories of the proposed semiblind in sudden arrival of users and non-stationary multipath channel with speed of 120km/s.