Distributed Antenna Selection for OFDM Space-Time Block Coded Diversity

(Invited Paper)

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***Abstract*—Antenna selection is an important issue for a distributed antenna-based small-cell network (DAN). This paper proposes a distributed antenna (DA) selection for DAN downlink using orthogonal frequency division multiplexing (OFDM) and space-time block coded (STBC) diversity. The proposed DA selection is an iterative algorithm which determines DA groups (each group consists of DAs communicating with a different user equipment (UE)) to maximize the downlink sum capacity by taking into account co-channel interference (CCI). In each iteration, one DA is added/removed to/from one of current DA groups if this increases the sum capacity by the largest amount. This is repeated until the sum capacity starts to decrease or by the prescribed number of times. It is shown by computer simulation that the proposed DA selection algorithm increases the 10% outage sum capacity by about 20% compared to the received signal power-based DA selection (no CCI is considered).**

Keywords-component; Distributed antenna-based small-cell network, Space-frequency block coding, antenna selection

I. INTRODUCTION

In the 5th generation (5G) mobile communications, high quality broadband data services are demanded over an entire service area. Distributed antenna (DA) based small-cell network (DAN) [1,2] is a promising network. However, the transmission quality of a user equipment (UE) near the macro-cell edge still degrades due to strong co-channel interference (CCI) from surrounding macro-cells. By utilizing multiple DAs found near UE, space-time block coding (STBC) diversity [3,4] can obtain a large spatial diversity gain and achieve higher macro-cell edge throughput than other multiple input multiple output (MIMO) transmission techniques such as spatial multiplexing and beamforming [5]. There exist two types of STBC diversity: STBC diversity with receive frequency-domain equalization (FDE) [6] and that with transmit FDE [7]. The former requires channel state information (CSI) at the receiver side while the latter requires it at the transmitter side. Therefore, by introducing STBC diversity with the receive FDE to the DAN uplink and that with the transmit FDE to the DAN downlink, all the FDE processing that requires CSI can be implemented at the network side [8].

To further improve the macro-cell edge throughput, macro-cell cooperation is effective. When UE is located near the macro-cell edge, there exist some DAs closer to that UE in adjacent macro-cells than those in the own macro-cell. Additional spatial diversity gain can be obtained by choosing DAs irrespective of own and adjacent macro-cells. However, the use of DAs in adjacent macro-cells may increase the CCI to adjacent macro-cells. Therefore, the DA selection needs to be done carefully by taking into account the CCI.

To solve the frequency-selectivity problem in broadband mobile communications, orthogonal frequency division multiplexing (OFDM) can be used. In this paper, we propose a DA selection for the DAN downlink using OFDM-STBC diversity. The proposed DA selection is an iterative algorithm which determines DA groups (each group consisting of DAs communicating with a different UE) to maximize the downlink sum capacity by taking into account CCI. In each iteration, one DA is added/removed to/from one of current DA groups if this increases the sum capacity by the largest amount. This is repeated until the sum capacity starts to decrease or by the prescribed number of times. It is shown by computer simulation that the proposed DA selection algorithm increases the 10% outage sum capacity by about 20% compared to the received signal power-based DA selection (no CCI is considered).

The remainder of this paper is organized as follows. Sect. II describes the DAN downlink using OFDM-STBC diversity. The downlink capacity expression is derived. Sect. III derives a recursive formula for computing the downlink capacity and then, proposes DA selection algorithm using the derived recursive formula. Sect. IV presents the computer simulation results. Sect. V offer the conclusions.

Notation : $E[.]$, $[.]^T$ and $[.]^*$ denote the ensemble average operation, the transpose operation and the complex conjugate operation, respectively.

II. MACRO-CELL COOPERATIVE DISTRIBUTED ANTENNA OFDM-STBC DIVERSITY

A. Network model

In this paper, DAN downlink using OFDM-STBC diversity is considered. Fig. 1 illustrates network model consisting of 19 macro-cells. 7 macro-cells in the center area are macro-cells of interest and are surrounded by 12 interfering macro-cells. In each macro-cell, 7 DAs are deployed and they are connected by optical fiber links to a macro-cell baseband unit (BBU). Each DA covers a hexagonal area with radius R'. In this paper, we assume that only one UE exists in each macro-cell and each UE is equipped with 2 antennas. UE in the c(=1~7)th macro-cell selects $N_{t,c}$ DAs as transmit diversity

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branches from 7×N_{DA} DAs located in own and adjacent macro-cells.

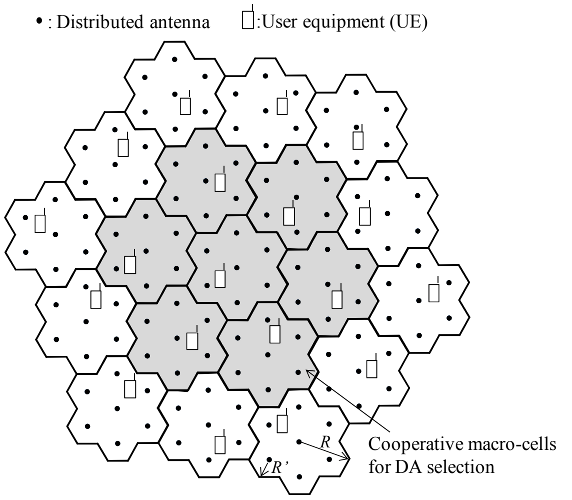
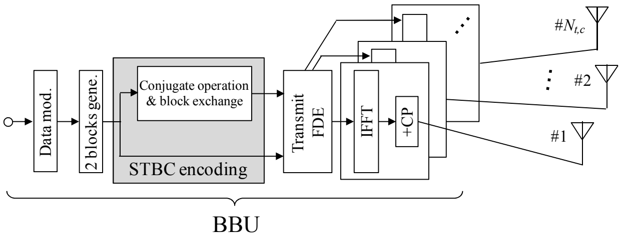
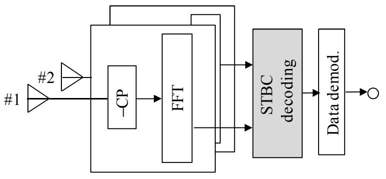


Fig. 1. Network model.



(a) Network side



(b) User equipment

Fig. 2. Transmit/receiver structures.

B. OFDM-STBC diversity with transmit FDE

Downlink transmission using OFDM-STBC diversity with the transmit FDE is described below. A simple 2 by 2 Alamouti STBC code is adopted in this paper. Without loss of generality, UE in the c(=1~7)th macro-cell is considered. Throughout this paper, the sample spaced discrete-time signal representation is used.

Fig. 2 shows the transmitter/receiver structures. At the transmitter (i.e. BBU), 2 blocks of N_c symbols each to be transmitted are encoded into the STBC coded signal represented in 2×2 matrix form $(\mathbf{X}_{c,1}\ \mathbf{X}_{c,2})$ as

$$\left(\mathbf{X}_{c,1}(k)\quad \mathbf{X}_{c,2}(k)\right)=\begin{pmatrix} D_{c,1}(k) & -D^*_{c,2}(k) \\ D_{c,2}(k) & D^*_{c,1}(k)\end{pmatrix}, \qquad (1)$$

where $D_{c,1}(k)$ and $D_{c,2}(k)$ denote the kth data symbols in the first and second N_c-symbol blocks before STBC encoding. Then, the transmit FDE is applied to the STBC coded signal to obtain the $N_{t,c}$×2 transmit signal represented by $(\mathbf{S}_{c,1}\ \mathbf{S}_{c,2})$, where $\mathbf{S}_{c,q}(k)=(S_{c,q}(k|1),\ldots,S_{c,q}(k|N_{t,c}))^T$, q=1,2, is given as $\mathbf{S}_{c,q}(k)=\mathbf{W}_c(k)\mathbf{X}_{c,q}(k)$ with $\mathbf{W}_c(k)=(\mathbf{W}_c(k|1)\ldots\mathbf{W}_c(k|N_r))$ is the $N_{t,c}\times N_r$ transmit FDE weight matrix and $\mathbf{W}_c(k|n_r)=(W_c(k|1,n_r)\ldots\ W_c(k|N_{t,c},n_r))^T$. In this paper, the transmit FDE weight based on maximal ratio transmission (MRT) criterion is used, i.e., $W_c(k|n_t,n_r)$ is given as

$$W_c(k\mid n_t,n_r)=\frac{H^*_{c,c}(k\mid n_t,n_r)}{\sqrt{\frac{1}{N_c}\sum_{k=1}^{N_c}\sum_{n_r=1}^{N_r}\sum_{n_t=1}^{N_t}\left|H_{c,c}(k\mid n_t,n_r)\right|^2}}, \qquad (2)$$

where $H_{c,c}(k|n_r,n_t)$ is the channel gain between the n_tth transmit DA and the n_rth receive antenna of UE and is introduced laterfor the kth subcarrier. After applying the transmit FDE, the OFDM-STBC signal is generated by N_c-point inverse fast Fourier transform (IFFT) and by inserting cyclic prefix (CP) and is transmitted from $N_{t,c}$ selected DAs.

At the UE receiver in the cth macro-cell, the received OFDM-STBC signal is decomposed into N_c subcarriers by N_c-point FFT. The qth received signals on N_r receive antennas can be represented as a vector $\mathbf{R}_{c,q}(k)=(R_{c,q}(1,k),\ldots,R_{c,q}(N_r,k))^T$ as

$$\begin{aligned}\mathbf{R}_{c,q}(k)&=\sqrt{2P_t}\,\mathbf{H}_{c,c}(k)\mathbf{S}_{c,q}(k)\\&\quad+\sqrt{2P_t}\sum_{c'\in\mathbf{C}_{c'}}\mathbf{H}_{c',c}(k)\mathbf{S}_{c',q}(k)+\mathbf{N}_{c,q}(k),\end{aligned} \qquad (3)$$

where P_t is the transmit signal power. $\mathbf{H}_{c,c}(k)=(\mathbf{H}_{c,c}(k|1)\ldots\mathbf{H}_{c,c}(k|n_t)\ldots\mathbf{H}_{c,c}(k|N_{t,c}))$ is the $N_r\times N_{t,c}$ channel matrix between the selected DA group and UE with $\mathbf{H}_{c,c}(k|n_t)=(H_{c,c}(k|n_t,1)\ldots H_{c,c}(k|n_t,n_r)\ldots H_{c,c}(k|n_t,N_r))^T$ and $H_{c,c}(k|n_t,n_r)$ being the channel gain between the n_tth transmit DA and the n_rth receive antenna of UE. In (3), the second term is CCI from adjacent macro-cells and the third term is noise. $\mathbf{H}_{c',c}(k)=(\mathbf{H}_{c',c}(k|1)\ldots H_{c',c}(k|n_t)\ldots\mathbf{H}_{c',c}(k|N_{t,c'}))$ with $\mathbf{H}_{c',c}(k|n_t)=(H_{c',c}(k|1,n_t)\ldots H_{c',c}(k|n_r,n_t)\ldots H_{c',c}(k|N_r,n_t))^T$ is the $N_r\times N_{t,c'}$ channel matrix between the selected DA group in the c'th macro-cell and UE in the c(=1~7)th macro-cell, $\mathbf{C}_{c'}$ denotes the group of macro-cells surrounding the cth macro-cell, and $\mathbf{N}_{c',q}(k)=(N_{c',q}(k|1)\ldots\ N_{c',q}(k|n_r)\ldots N_{c',q}(k|N_r))^T$ is the noise vector, where $N_{c',q}(k|n_r)$ is the zero-mean complex-valued additive white Gaussian noise (AWGN) having variance $2N_0/T_s$ with N_0 and T_s being the single-sided power spectrum density of AWGN and the data symbol duration, respectively.

STBC decoding is performed to obtain the received symbols, $\hat{D}_{c,1}(k)$ and $\hat{D}_{c,2}(k)$, as

$$\begin{pmatrix}\hat{D}_{c,1}(k)\\ \hat{D}_{c,2}(k)\end{pmatrix}=\begin{pmatrix}R_{c,1}(1,k)+R^*_{c,2}(2,k)\\ R_{c,1}(2,k)-R^*_{c,2}(1,k)\end{pmatrix}. \qquad (4)$$

Finally, data demodulation is carried out.

C. Downlink capacity

The downlink capacity C_c (bps/Hz) of UE in the cth macro-cell is given as

$$C_c = \frac{1}{N_c}\sum_{k=1}^{N_c}\log_2\left(1+\gamma_c(k)\right), \tag{5}$$

where $\gamma_c(k)$ is the received signal-to-interference and noise power ratio (SINR) for the kth subcarrier and is given as

$$\gamma_c(k) = \frac{P_t\left|\sum_{n_r=1}^{N_r}\sum_{n_t=1}^{N_{t,c}} H_{c,c}(k\,|\,n_r,n_t)W_c(k\,|\,n_t,n_r)\right|^2}{P_t\sum_{c'\in\mathbf{C}_{c'}}\sum_{n_r=1}^{N_r}\sum_{n_t=1}^{N_{t,c'}}\left|H_{c',c}(k\,|\,n_r,n_t)W_{c'}(k\,|\,n_t,n_r)\right|^2+(N_0/T_s)\cdot N_r}. \tag{6}$$

The first term in the denominator of (6) is the contribution of CCI from adjacent macro-cells and the second term is that of noise. (6) implies that the received SINR $\gamma_c(k)$ increases by increasing the maximum number $N_{t,max}$ (design parameter) of DAs to be selected, but the CCI also increases. Therefore, in order to improve the downlink capacity, DA selection needs to be done carefully by taking into account the CCI.

III. DISTRIBUTED ANTENNA SELECTION ALGORITHM

Denoting $\mathbf{N}_{\mathbf{t},c}$ as the DA group for UE in the cth macro-cell, the problem of maximizing the downlink sum capacity by taking into account CCI is expressed as

$$\left\{\mathbf{N}_{\mathbf{t},c}; c=1,\ldots,19\right\} = \arg\max_{\mathbf{N}_{\mathbf{t},c}}\sum_{c=1}^{19} C_c\,. \tag{7}$$

Since the number of DA group candidates is extremely large, the exhaustive search cannot be used. In this paper, we propose an iterative algorithm using recursive equation.

A. Recursive equation for downlink capacity computation

Substituting (2) into (6) gives

$$\begin{aligned}\gamma_c(k) &= \frac{\hat{P}_t\,\tilde{\mathrm{A}}_c^2(k)/\tilde{\mathrm{B}}_c}{\hat{P}_t\sum_{c'\in\mathbf{C}_{c'}}\left(\tilde{\mathrm{X}}_{c',c}(k)/\tilde{\mathrm{X}}_{c'}\right)+(N_0/T_s)\cdot N_r}\\ &\equiv \frac{P_s(k)}{P_{cci}(k)+P_{noise}}\end{aligned}, \tag{8}$$

where

$$\begin{cases}\tilde{\mathrm{A}}_c(k)=\sum_{n_t=1}^{N_{t,c}}\mathrm{A}_c(k\,|\,n_t), & \mathrm{A}_c(k\,|\,n_t)=\sum_{n_r=1}^{N_r}\left|H_{c,c}(k\,|\,n_r,n_t)\right|^2\\ \tilde{\mathrm{B}}_c=\sum_{n_t=1}^{N_{t,c}}\mathrm{B}_c(n_t), & \mathrm{B}_c(n_t)=\frac{1}{N_c}\sum_{k=1}^{N_c}\mathrm{A}_c(k\,|\,n_t)\\ \tilde{\mathrm{X}}_{c,c'}(k)=\sum_{n_t=1}^{N_{t,c'}}\mathrm{X}_{c,c'}(k\,|\,n_t) & \\ \mathrm{X}_{c,c'}(k\,|\,n_t)=\sum_{n_r=1}^{N_r}\left|H_{c',c}(k\,|\,n_r,n_t)H^*_{c',c'}(k\,|\,n_r,n_t)\right|^2 & \end{cases}. \tag{9}$$

From (8), the following recursive formula is obtained for computing the downlink capacity $C_{c,\mathbf{N}^{\pm}_{\mathbf{t},c'}}$ of the cth macro-cell after adding/removing the n_t'th DA to/from $\mathbf{N}_{\mathbf{t},c'}$:

$$C_{c,\mathbf{N}_\mathbf{t}^{\pm}} = C_{c,\mathbf{N}_\mathbf{t}} + \sum_{k=1}^{N_c}\log_2\left(\frac{1+\alpha_{c,c'}(k\,|\,n_t{}')\gamma_{c,\mathbf{N}_\mathbf{t}}(k)}{1+\gamma_{c,\mathbf{N}_\mathbf{t}}(k)}\right), \tag{10}$$

with $\mathbf{N}_\mathbf{t}=(\mathbf{N}_{\mathbf{t},1}\ldots.\mathbf{N}_{\mathbf{t},c}\ldots\mathbf{N}_{\mathbf{t},19})$ and $\mathbf{N}_\mathbf{t}^{\pm}=(\mathbf{N}_{\mathbf{t},1}\ldots\mathbf{N}_{\mathbf{t},c'}\pm n_t'\ldots\mathbf{N}_{\mathbf{t},19})$. $C_{c,\mathbf{N}_\mathbf{t}}$ and $\gamma_{c,\mathbf{N}_\mathbf{t}}(k)$ are respectively the downlink capacity and the received SINR before adding/removing the n_t'th DA to/from $\mathbf{N}_{\mathbf{t},c'}$. $\alpha_{c,c'}(k\,|\,n_t{}')$ is given as

$$\alpha_{c,c'}(k\,|\,n_t') = \begin{cases}\left(\dfrac{1+\varepsilon_{c'}(n_t')\mathrm{A}_c(k\,|\,n_t')/\tilde{\mathrm{A}}_c(k)}{1+\varepsilon_{c'}(n_t')\mathrm{B}_c(n_t')/\tilde{\mathrm{B}}_c}\right)^2 & \text{if } c=c'\\ \dfrac{1}{1+\dfrac{1}{P_{cci}(k)+P_{noise}}\left(\dfrac{\tilde{\mathrm{X}}_{c,c'}(k)}{\tilde{\mathrm{B}}_{c'}}-\dfrac{\tilde{\mathrm{X}}_{c,c'}(k)+\varepsilon_{c'}(n_t')\mathrm{X}_{c,c'}(k\,|\,n_t')}{\tilde{\mathrm{B}}_{c'}+\varepsilon_{c'}n_t'\mathrm{B}_{c'}(n_t')}\right)} & \text{otherwise}\end{cases}, \tag{11}$$

where $\varepsilon_{c'}(n_t{}')$=+1/–1 when the n_t'th DA is added to/removed from $\mathbf{N}_{\mathbf{t},c'}$.

B. DA selection algorithm

The flowchart of the proposed DA selection using recursive equation (10) is shown in Fig. 3. At first, $N_{t,max}$ DA candidates are determined in descending order of instantaneous received signal power. From $N_{t,max}$ DA candidates, $N_{t,ini}$ DAs having highest received signal powers are selected as an initial DA group $\mathbf{N}_{\mathbf{t},c}^{(0)}$, c=1,…,19. Then, the initial values of $\tilde{\mathrm{A}}_c(k), \tilde{\mathrm{B}}_c$, $\tilde{\mathrm{X}}_{c,c'}(k)$, $\gamma_c(k)$ and C_c are computed using (5), (6), (8), and (9). They are denoted by $\tilde{\mathrm{A}}_c^{(0)}(k)$, $\tilde{\mathrm{B}}_c^{(0)}$, $\tilde{\mathrm{X}}_{c,c'}^{(0)}(k)$, $\gamma_c^{(0)}(k)$ and $C_c^{(0)}$.

Below, the i(=1~ I_{max})th iteration is described. To find the DA which maximizes the change of downlink sum capacity, the change of downlink sum capacity when adding/removing the n_t'th DA to/from $\mathbf{N}_{\mathbf{t},c'}^{(i)}$ is computed using

$$\Delta C_{sum,c'}^{(i)}(n_t') = \sum_{c=1}^{7}\Delta C_{c,c'}^{(i)}(n_t') \tag{12}$$

with

$$\Delta C_{c,c'}^{(i)}(n_t') = \sum_{k=1}^{N_c}\log_2\left(\frac{1+\alpha_{c,c'}^{(i-1)}(k\,|\,n_t')\gamma_c^{(i-1)}(k)}{1+\gamma_c^{(i-1)}(k)}\right), \tag{13}$$

where $\alpha_{c,c'}^{(i-1)}(k\,|\,n_t')$ is obtained from (11) by replacing $\mathrm{A}_c(k), \mathrm{B}_c, \mathrm{B}_{c'}$ and $\mathrm{X}_{c,c'}(k)$ with $\tilde{\mathrm{A}}_c^{(i-1)}(k), \tilde{\mathrm{B}}_c^{(i-1)}, \tilde{\mathrm{B}}_{c'}^{(i-1)}$ and $\tilde{\mathrm{X}}_{c,c'}^{(i-1)}(k)$ respectively. If the $\hat{n}_t$ th DA in the $\hat{c}$ th macro-cell is found to maximize the change of downlink sum capacity and $\Delta C_{sum,\hat{c}}^{(i)}(\hat{n}_t)$ is larger than 0, the $\hat{n}_t$ th DA in the $\hat{c}$ th macro-cell is decided to add/remove to/from $\mathbf{N}_{\mathbf{t},\hat{c}}$ and the downlink capacity is updated as

$$C_c^{(i)} = C_c^{(i-1)} + \varepsilon_{\hat{c}}(\hat{n}_t)\Delta C_{c,\hat{c}}^{(i)}(\hat{n}_t). \quad (14)$$

After updating the downlink capacity, $\gamma_c(k), \widetilde{\mathrm{A}}_c(k), \widetilde{\mathrm{B}}_c$, and $\widetilde{\mathrm{X}}_{c,c'}(k)$ are updated for the next (i+1)th iteration as

$$\begin{cases} \gamma_c^{(i)}(k) = \gamma_c^{(i-1)}(k) + \varepsilon_{\hat{c}}(n_t')\alpha_{c,\hat{c}}^{(i-1)}(k \mid \hat{n}_t)\gamma_c^{(i-1)}(k) \\ \widetilde{\mathrm{A}}_c^{(i)}(k) = \widetilde{\mathrm{A}}_c^{(i-1)}(k) + \begin{cases} \varepsilon_{\hat{c}}(n_t')\mathrm{A}_c(k \mid \hat{n}_t) & \text{if } c = \hat{c} \\ 0 & \text{otherwise} \end{cases} \\ \widetilde{\mathrm{B}}_c^{(i)} = \widetilde{\mathrm{B}}_c^{(i-1)} + \begin{cases} \varepsilon_{\hat{c}}(\hat{n}_t)\mathrm{B}_c(\hat{n}_t) & \text{if } c = \hat{c} \\ 0 & \text{otherwise} \end{cases} \\ \widetilde{\mathrm{X}}_{c,c'}^{(i)}(k) = \widetilde{\mathrm{X}}_{c,c'}^{(i-1)}(k) + \begin{cases} 0 & \text{if } c = \hat{c} \\ \varepsilon_{\hat{c}}(\hat{n}_t)\mathrm{X}_{c,\hat{c}}(\hat{n}_t, k) & \text{otherwise} \end{cases} \end{cases} \quad (15)$$

The above procedure is repeated until the sum capacity change turns to become negative (i.e., the present set of DA groups gives the maximum sum capacity). If the capacity change does not become negative even repeating the above procedure by the prescribed number I_{max} of times, the DA group updating is terminated.

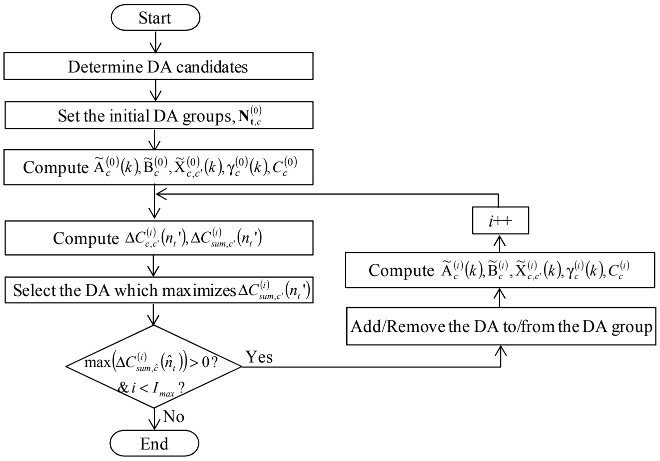


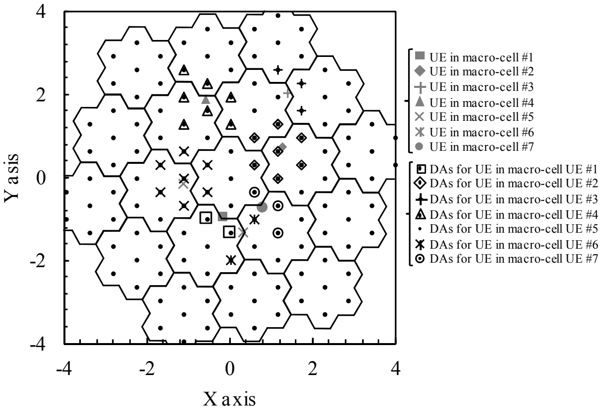
Fig. 3. Flow chart of the proposed DA selection.

IV. COMPUTER SIMULATION

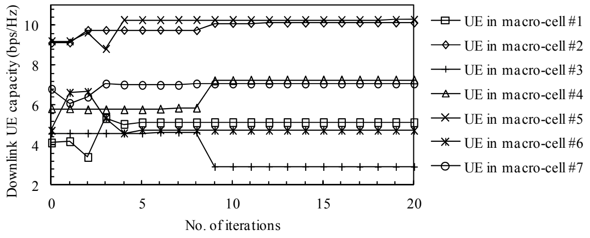
We evaluate, by the computer simulation, the downlink capacity of OFDM-STBC diversity using the proposed DA selection algorithm. The FFT block size N_c and the CP length N_g are set to 128 symbols and 16 samples, respectively. The number N_r of UE antennas is set to 2. The number $N_{t,max}$ of DA candidates and the number $N_{t,ini}$ of DAs to be selected for the initial DA group are set to 7 and 3, respectively. The maximum number I_{max} of iterations is set to 30. The path loss exponent α and the shadowing loss standard deviation σ are assumed to be 3.5 and 7.0dB, respectively. When the UE-DA distance is shorter than R', the channel is assumed to be a frequency-selective Nakagami-Rice fading having direct-to-delay path power ratio K=10dB and L=16-path uniform power delay profile. On the other hand, when the UE-DA distance is longer than R', the channel is assumed to be a frequency-selective Rayleigh fading having an L=16-path uniform power delay profile. Interference limited environment is considered. Perfect knowledge of channel state information is assumed.

A. Behavior of the proposed DA selection

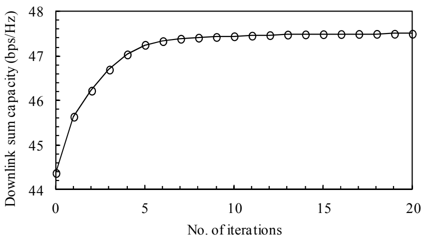
Fig. 4(a) sketches DA groups formed by the proposed DA selection. To simplify the discussion, the channel was assumed to be characterized by propagation path loss only. It is seen from Fig. 4(a) that the proposed DA selection allocates more DAs to an UE which experiences a good channel condition, while it allocates less number of DAs to an UE which experiences a bad channel condition in order to reduce CCI to adjacent macro-cells. Fig. 4(b) and (c) show the downlink UE capacity and the downlink sum capacity, respectively, at each iteration stage. Clearly seen from Fig. 4(c) is that the proposed successive DA selection converges within 20 iterations. We also examined the computational complexity of the proposed DA selection algorithm and found that the proposed algorithm requires much less complexity while achieving satisfactory sum capacity compared to the exhaustive search.



(a) DA groups formed by the proposed DA selection



(b) Downlink UE capacity



(c) Downlink sum capacity

Fig. 4. Behavior of proposed DA selection.

B. *Cumulative distribution function of downlink capacity*

Fig. 5 plots the cumulative distribution function (CDF) of downlink UE capacity when using proposed DA selection. The value of downlink capacity at the *x*% of CDF is defined as the *x*% outage downlink capacity. For comparison, the CDF of downlink UE capacity when using the received signal power-based DA selection (no CCI considered) is also plotted. When using the received signal power-based DA selection, $N_{t,max}$ DAs are always selected. It is seen from Fig. 5 that the proposed DA selection can achieve higher downlink UE capacity than the received signal power based DA selection. For example, the proposed DA selection increases the 10% (50%) outage UE capacity by about 10% (20%) compared to the received signal power-based DA selection. However, when compared at the 1% outage downlink capacity, the proposed DA selection underperforms than the received signal power-based DA selection. This is because the proposed DA selection allocates less number of DAs to UE experiencing a bad channel condition in order to reduce CCI to adjacent macro-cells.

Fig. 6 plots the CDF of downlink sum capacity when using the proposed DA selection. The proposed DA selection always achieves higher capacity than the received signal power-based DA selection. For example, the proposed DA selection increases the 10% (50%) outage sum capacity by about 20% (14%) compared to the received signal power-based DA selection.

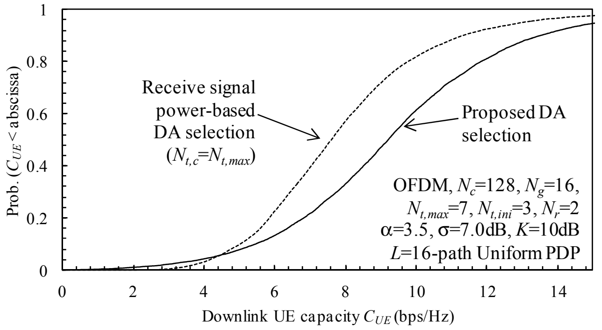


Fig. 5. CDF of downlink UE capacity.

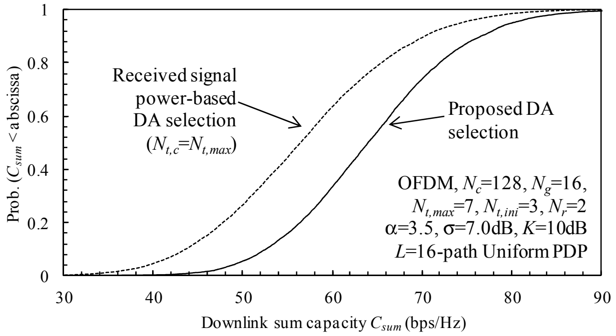


Fig. 6. CDF of downlink sum capacity.

V. CONCLUSIONS

In this paper, we proposed a DA selection algorithm for the DAN downlink using OFDM-STBC diversity. The proposed DA selection is an iterative algorithm which determines DA groups (each group consisting of multiple DAs communicating with a different UE) to maximize the sum capacity by taking into account CCI. It was shown by computer simulation that the proposed DA selection increases the 10% outage sum capacity by about 20% compared to the received signal power-based DA selection (no CCI considered). Capacity analysis of the proposed DA selection algorithm, comparison to exhaustive search, and multi-user scheduling are left as our future study.

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