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User Assignment Algorithm for Energy Efficient Multiple Access Scheme of MIMO-OFDMA Systems

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Abstract: - Energy Efficiency (EE) is the important issue for multi-user Multiple-Input Multiple-Output - Orthogonal Frequency-Division Multiple Access (MIMO - OFDMA) system. In this paper, the Energy-efficient Multiple Access (EMA) schemes are proposed to improve EE by selecting either Time-Division Multiple Access (TDMA) or Space-Division Multiple Access (SDMA) for each subband, based on the number of users and power consumption. The polynomial-complex and greedy-based user assignment algorithms for the EMA system are adapted to Maximize energy efficiency. System complexity and energy efficiency are compared. Simulation Results verified that the EE of Greedy (GUSA) algorithms could significantly improve energy efficiency with practically compare to Fine EMA algorithm with increasing complexity.

Keywords: - Energy efficiency (EE), channel access method, multiple access methods, time-division multiple access (TDMA), space-division multiple access (SDMA), orthogonal frequency-division multiple access (OFDMA), EMA, user assignment, greedy algorithm.

1. Introduction

Energy efficiency is becoming increasingly important for mobile communications. The energy efficiency of the transmissions the base station has the increasing demand for the higher data rates, low error rate and enhanced coverage lead to higher energy consumption. Orthogonal frequency division multiple access (OFDMA) has studied for the next generation wireless communication systems, such as WiMAX and the 3GPP LTE. OFDM which maximizes the energy efficiency (EE) (i.e., bits-per-Joule) [1]-[3]. we aim to improve the bits/Joule average energy efficiency (EE) OFDMA using Energy-efficient multiple access (EMA) scheme for Multiuser MIMO –OFDM System using user assignment algorithm[1].

The important issue is to improve the energy efficiency (EE) of multi-user multiple-input-multiple-output (MIMO) orthogonal frequency-division multiple access (OFDMA) system. Energy-efficient multiple access (EMA) schemes are proposed. EMA scheme selects either TDMA or SDMA for each subband[1]. The target is to improve the EE maximize and reduce the complexity of the system polynomial-complex and greedy-based user assignment algorithms for the EMA system is Proposed to Maximize energy efficiency. Using energy efficient design SDMA time slots , EE is derived [2].

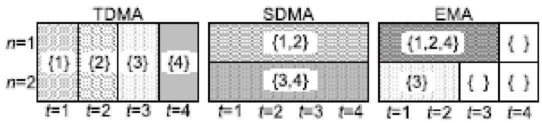

Fig. 1. Examples of TDMA, SDMA, and EMA for four users when M = 3,N = 2 and T =4.The numbers in braces represent the user indices supported.

In this paper, we study the MU EE of SDMA for MU-MIMO orthogonal frequency-division multiple access downlink communications. The EE is as the average throughput per total energy consumed by the user that is Energy Efficiency (EE) of a multiuser (MU) communications can be defined variously [1]–[7].

With per-user achievable rate Ru, outage ϵ_U, and power consumption (PC) P_u, the MU EEs are defined, for example, as follows :

$EE1 = E((1-\epsilon_U)\ R_U\ /\ P_U)$ average per-user EE

$EE2=E((1-\epsilon_U)R_U)/E(P_U)$ network EE (1)

Where u is a user index. For a single user (SU) communications, EE1 = EE2. It is, however, obvious that overhead PC reduction sustaining the communications performance ϵ_U improves the MU EEs. Since the PC of MU communications depends on multiple access (MA) methods, such as a time division multiple accesses (TDMA) and a zero-forcing (ZF)-based space-division multiple access (SDMA), the MU EE also depends on the MA methods.

For a given frequency band, the SDMA requires fever time slots to support the same K users by compromising the power consumption (PC). Because of this SDMA requires the different amount of energy. So in previous work EMA scheme is proposed which selects either SDMA or TDMA for each sub-band to maximize the EE. Simple algorithms for the EMA system are Fine & Coarse EMA algorithm & proposed greedy based user assignment algorithm are devised, and their EE performances are verified numerically[1]. In this paper, we are considering the system model & detection schemes as proposed System & the previous woks [1, 2].

Rest of paper organized as follows In Section 2 defines literature review, In 3 EMA System Model & the optimization of energy Efficient SDMA & OFDMA Design. 4.The power consumption analysis using SDMA & TDMA and the 5.proposed EMA algorithm & previous work EMA algorithm is presented in Section 6 the numerical results in Section, and conclusion in Section 7.

2. Literature review

A multiple-input-multiple-output (MIMO) system consists of multiple antennas at the transmitter and receiver. The energy efficiency has become one of the mainstreams in mobile multimedia communication systems, including transmission power allocation, Bandwidth allocation, Subchannel allocation etc. Multi-input multi-output (MIMO) technologies can create independent parallel channels to transmit data streams, which improves spectrum efficiency and system capacity without increasing the bandwidth requirement [3].A modulation strategy is introduced that minimizes the total energy consumption for transmitting a given number of bits in a single input and single output (SISO) AWGN channel [4]. A coordinated power allocation method is developed to balance the weighted SINR in a multi-cell massive multiple input single output (MISO) downlink system [5].

An Energy-Efficient pilot design in downlink system is studied for a single user (SU) case, and the optimal overall transmit power, and the power allocation between pilots and data symbols are investigated they have developed an algorithm with fractional programming to give near-optimal energy efficiency. It also talks about the problems of joint power allocation and beamforming for coordinated multi-cell multiuser downlink systems [5]. The energy-efficient resource allocation in both downlink and uplink cellular networks with orthogonal frequency division multiple access (OFDMA). For the downlink transmission, the generalized energy efficiency (EE) is maximized while for the uplink case the minimum individual EE is maximized under quality-of-service (QoS) requirements. Uplink energy efficient communications in OFDMA systems to improve utilization of mobile energy [7]. Power amplifier (PA) banks are used to do switching which in turn proposes a switching method to improve the energy efficiency of a transmit antenna. It proposes a PAS with multiple dissimilar PAS for a transmit antenna selection and maximum ratio combining (TAS-MRC) system to improve its average system EE [9].

3. EMA System Model Using SDMA-OFDMA Design

We consider a downlink communications system in which an M-antenna transmitter communicates with U single antenna users (receivers) through N orthogonal frequency subbands. Denote a U-by-M channel matrix of subband $n \in N = \{1, . . N\}$ by Hn, whose (u,m)th element hum is channel gain between the transmit antenna $m \in M = \{1, . . . , M\}$ and user $u \in U = \{1, . . . , U\}$. The channel is assumed to be static for T slots and vary in every T slots independently, i.e., a quasistatic channel with coherence time T. Each subband n supports K users where $K \leq T = [U/N]$. Throughout the paper, we assume that $KN \geq U$ and a scheduling function $\pi(n)$ = Un assigns user $u \in$ Un to subband n. An SDMA-OFDMA system is considered. Each subband n supports up to M, each of which receives a single stream, through a zero-forcing (ZF)-based multiuser MIMO precoding with M transmit (TX) antennas. Hence, the maximum number of accommodated users could be ideally MN.

Denote a set of users who are associated to the subband n by Un ∈ U. The |Un|-by-1 received signals of |Un| users of subband n are represented by a column vector as

$$y_n = H_n W_n \sqrt{Q_n} x_n + v_n \in \mathbb{C}^{|u_n| \times 1} \quad (2)$$

Where the |Un|-by-M MU-MIMO channel matrix Hn consists of parts of row vectors of a whole MU-MIMO channel matrix, i.e., $H_n = [H_n]\, U_n \in \mathbb{C}^{|u_n| \times M}$; the M-by-|Un| ZF-MU-MIMO precoding matrix $W_n \in \mathbb{C}^{M \times} U_n$ is a pseudo inverse of the channel matrix, i.e., Wn = H_n^* = $[H_n^-]\, {}^{*}_{U_n}$, the power control matrix Qn ∈ R|Un|×|Un | is a |Un|-by-|Un| diagonal matrix whose kth diagonal element qk controls user U's TX power to satisfy the individual TX power constraint and target rate, and x_n and v_n are the $|U_n|$-by-1 signal and additive white Gaussiannoise (AWGN) column vectors, respectively. The AWGN at user u obeys a zero-mean complex normal distribution with σ^2 variance; i.e., V_n,u ~ CN (0, σ^2).

To achieve target rate R, a conventional SDMA system uses a single time slot for each transmission of the SDMA signal $W_n \sqrt{Q_n} x_n$, which includes the amount of R-bit information. In general, however, TX can use Ln SDMA time slots ($1 \le L_n \le T$), to achieve a bit rate of R as the channels are static during T slots as assumed in [4]. Thus, to achieve a bit rate of R during Ln slots, each user should achieve at least

R/ L_n per slot through a bandwidth of Ω Hz; i.e.,

$$\Omega \log_2(1+\mathrm{SNR}) \ge R\, L_n^{-1} \quad (3)$$

Where SNR is the signal-to-noise ratio (SNR) of the SDMA user, u derived as SNR = $qu\sigma^{-2}$ from (1). Note that the user, frequency and time indices, namely u, n and t, can be retrieved from a scheduling function as they are uniquely mapped to one another. From (2), we derived the lower bound of qu as

$$Q_u \ge \left(2^{R/(L_n \Omega)} - 1\right) \triangleq \bar{q}\, L_n\,, \quad \forall u \in U_n \quad (4)$$

the other hand, q_u should also fulfill the individual TX power constraint such that

$$P_{mn} = \| W_{mn}^{r} \sqrt{Q_n} \|^2 \le P_{max} \quad (5)$$

Where P_{mn} is the TX power antenna m of subband n, and $W_{mn}^{r} \in \mathbb{C}^{1 \times |u_n| \times M}$ is the mth row vector of Wn. We design R according to the receiver's capability and assume that a transmission rate higher than R is not recovered perfectly at the receiver. Therefore, the minimum TX power that achieves R/Ln at time t on subband n maximizes EE, and the minimum TX power for a given Ln is derived as [4]

$$P(L_n) = \min \sum_{m \in M} P_{mn} = \sum_{m \in M} \bar{q}\, L_n \, \| W_{mn}^{r} \|^2 = \bar{q} L_n \| W_n \|^2_F \quad (6)$$

Where $\bar{q}L_n$ is defined in (4), Under the assumption of a sufficiently large P_{max} such that (5) is always feasible, the instantaneous EE of SDMA of the whole subband is modeled with (6) as

$$EE = UR\, \left(C \sum_{n \in N} (L_n P\,(L_n)\, + \max\{L_n\}\, P_{fix}\right)^{-1} \quad (7)$$

EE of EMA System of each subband is defined as

$$EE = \frac{UR}{c \sum_{n \in N} P_{tx,n} + \max\{L_n\}\, P_{fix}} \quad (8)$$

Where R is a fixed target rate of each user, which implicitly involves an equality rate constraint, i.e.

R = $(1 - \epsilon_u) R_u$, and is always feasible with allowing unlimited transmit power and ideal coding and decoding for each subband (user). Where c represents the system inefficiency (c > 1) that is caused by overhead power consumption in radio frequency (RF) circuits; and Pfix is the fixed power consumption per time slot. In (8), the first and the second terms of the denominator are TX-power-dependent (TPD) and TX-power independent (TPI) power consumption terms,respectively, which follows from the fact that an RF chain should be turned on at t if there is at least one SDMA slot to be transmitted at t over any subband. To maximize the EE in (7), we design Ln and Wn for all n ∈ N to minimize the total power consumption of SDMA, where it should be noted that the power consumption always guarantees the achievable rate UR to optimal MA configuration maximizing (8). The combinatorial search for the optimal EMA requires O(TN) time complexity, and it can be a burden of the transmitter when T or N is large. In the next section, we derived the PC of TDMA and SDMA precisely and proposed Algorithm & two suboptimal EMA Algorithms.

4. Analysis of EMA Algorithms

The proposed system work polynomial-complex and greedy-based user assignment algorithms for the EMA system. By conducting complexity analysis and energy efficiency comparison. We verify that the proposed algorithms can significantly improve energy efficiency with practically tractable complexity a greedy-over-UA (GUA) algorithm and a greedy-over-user-and-subband assignment (GUSA) algorithm. Design of EE user assignment greedy algorithms SDMA –OFDMA Energy Efficient Multiple Access schemes is considered. In exciting system work as to improve EE-aware MA (EMA) this method that finds an EE-aware number of SDMA time slots and selects either SDMA or TDMA for each subband to maximize the EE. Two simple algorithms for the EMA discussed for analysis of EE design energy efficient channel access methods as power consumption of SDMA & TDMA for each subband.

Existing EMA Algorithms

We find a near-optimal EMA that maximizes the lower bound of EE in (8), which is equivalent to maximize an EE per subband and realized by minimizing PC per subband n defined as

$$\mathrm{PC_n} = \mathrm{CP_{tx},n} + \mathrm{LnP_{fix}}$$

To determine an MA for each subband, we derive the minimum PC of that achieves R for any user in a TDMA or SDMA mode and proposed EMA algorithms.as follows :

A. PC OF TDMA

We first derive the PC of TDMA with OFDMA. To allow the target rate R of user u through the sub-band with bandwidth Ω and variance the power control factor up is lower bounded as

$$\mathbf{P_u} \geq \boldsymbol{\sigma}^2(\mathbf{2R/\Omega}\text{-}1)\, \mathbf{g_u^{-1}} \qquad \forall_u \in u \quad (9)$$

Where $\mathbf{g_u}$ is the channel matrix, Therefore, the minimum transmit power achieving R is derived for the TDMA user u as

$$\mathbf{P^{TDMA}_{tx,u}} = \min\{ \prod \mathbf{b_u} \prod^2 \mathbf{p_u} \}$$

$$= g_u \min \{\mathbf{p_u}\} = \boldsymbol{\sigma}^2 (2^{\frac{\mathbf{R}}{\boldsymbol{\sigma}}}\text{-}1). \quad (10)$$

Since K users are supported through K time slots, the PC in (10) is derived for the TDMA as follows:

$$\boldsymbol{P_n^{TDMA}} = \mathrm{c} \sum_{\boldsymbol{u}\in\boldsymbol{u_n}} \boldsymbol{P_{tx,u}^{TDMA}} + \mathrm{KP_{fix}}$$

$$= \mathrm{cK}\boldsymbol{\sigma}^2 \left(\mathbf{2}^{\frac{\boldsymbol{R}}{\boldsymbol{\sigma}}} - \mathbf{1}\right) + \mathrm{KP_{fix}} \quad (11)$$

B. PC OF SDMA

PC of SDMA with OFDMA is derived. Since the SDMA can be implemented with L_n time slots ($1 \leq L_n \leq T$), each sub-band supports the K users with less time slots in fair comparison with TDMA. To allow the target rate R of user u ∈Un with Ln SDMA slots through the bandwidth Ω, the minimum required transmit power on each sub-band is derived for one SDMA time slot as follows:

$$\boldsymbol{P_{tx,n}^{SDMA}} = \min\left\{\sum_{\boldsymbol{m}\in\boldsymbol{M}} \| \boldsymbol{w^r_{mn\sqrt{Qn}}} \|^2\right\}$$

$$= \sum_{\boldsymbol{m}\in\boldsymbol{M}} \boldsymbol{\sigma}^2 (\mathbf{2}^{\frac{\boldsymbol{R}}{\boldsymbol{Ln\sigma}}} - \mathbf{1}) \| \boldsymbol{w^r_{mn}} \|^2$$

$$= \boldsymbol{\sigma}^2 (2^{\frac{\boldsymbol{R}}{\boldsymbol{Ln\sigma}}}\text{-}1) \| \boldsymbol{Wn} \|^2 \mathrm{F} \qquad (12)$$

Where $\|.\|^2_{\mathrm{F}}$ is the Frobenius norm of a matrix. Since Ln SDMA time slots are used to support the K users, the PC is derived for the SDMA ($1 \leq L_n \leq T$)

$$\boldsymbol{PC_n^{SDMA}} = \mathrm{c}\boldsymbol{L_n}\, \boldsymbol{P_{txn}^{SDMA}} + \boldsymbol{L_n P_{fix}}$$

$$= \mathrm{c}\boldsymbol{L_n}\, \boldsymbol{\sigma}^2 (\mathbf{2}^{\boldsymbol{R}/}\boldsymbol{L_n\, \Omega} - \mathbf{1}) \|\boldsymbol{W_n}\| 2\mathrm{F} + \boldsymbol{L_n P_{fix}} \qquad (13)$$

C. FINE-EMA ALGORITHM

It means to find the optimal MA for each subband n to compare $\mathrm{PC^{TDMA}n}$ in (11) and $\mathrm{PC^{SDMA}n}$ in (13) Ln =1. .T which require orthogonal time complexity. To reduce complexity for large N this is typical with an OFDMA system. Precisely one-dimensional line search is required N times. SDMA have PC_n is high then it preferred for SDMA time slots for K user less than K SDMA time slot activated with higher TPD PC which may increase EE significantly. We find the closed form of near-optimal number of SDMA slots for each subband n, denoted by L^0_n, through the relaxation of the integer L_n. For subband n, we first relax the integer L_n to a floating value L_n in (13), and get a convex, differentiable objective function over L_n as

$$\mathrm{f}(\boldsymbol{L_n}) = \mathrm{c}\boldsymbol{L_n}\, \boldsymbol{\sigma}^2\, (\mathbf{2}^{\boldsymbol{R}/}\boldsymbol{L_n\, \Omega}) \|\boldsymbol{W_n}\| 2\mathrm{F} + \boldsymbol{L_n P_{fix}} \qquad (14)$$

Next, We find the minimizer L^*_n which makes the first derivative of with $\mathrm{f}(\boldsymbol{L_n})$ respect to L_n be zero, as follows

$$l_n^* = \frac{R l_n 2}{\Omega\left(W\left(\frac{1}{exp(1)}\left(\frac{Pfix}{C_\sigma 2\|W_n\|^2{}_F}\right)\right)+1\right)} \quad (15)$$

Where exp(·) is an exponential function and $W(\cdot) \geq -1$ denotes the upper branch of Lambert W function, which satisfies $Z = W(z)e^{W(z)}$. From (15) we finally obtain the near-optimal SDMA slot length L_{on} that is the nearest integer to L^*n and satisfies $1 \leq Lon \leq T$. After finding Lon, we compare $PC^{TDMA}n$ and $PC^{SDMA}n$ to determine MA on subband n. Since only one pair of comparison is required for each subband, the complexity is reduced to O(N).The MA selection policy of EMA is designed by comparing $PC^{TDMA}n$ and $PC^{SDMA}n$ as follows:

$$EMA = \begin{cases} SDMA, & \text{if } \|W_n\|^2{}_F \leq \epsilon_n \\ TDMA, & \text{otherwise,} \end{cases} \quad (16)$$

Where ϵ_n is derived from ' $PC_n^{TDMA} \geq PC_n^{SDMA}$, as $\epsilon_n = \frac{(T-L_n^0)P_{fix}}{cL_n^0\sigma^2\,(2^{R/L_n^0\Omega}-1)} + \frac{K\left(2^{\frac{R}{\Omega}}-1\right)}{L_n^0\left(2^{R/L_n^0\Omega}-1\right)}$ (17)

EMA for each subband. Since in ϵ_n (17) is a monotonically increasing function over R, while $\|W_n\|^2{}_F$ is independent of R, larger R increases the probability to select SDMA in (16).To guarantee EE improvement, we further compare the EE of pure TDMA that uses TDMA for all subbands and the EE of the fine EMA, and determine the MA that achieves the higher EE. Fine EMA can effectively improve the EE with low complexity, regardless of the target rates, PC models, and channel conditions.

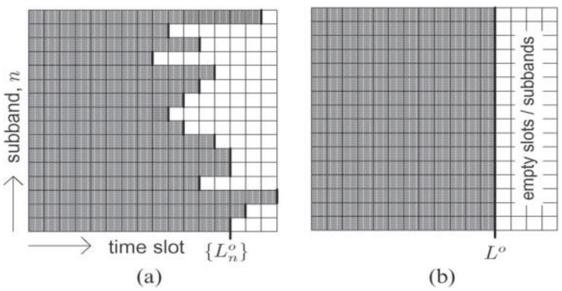

Fig.2 . Illustration of the proposed EMA. a) Fine-EMA algorithm: SDMA with $1 \leq L_n^0 \leq T$ or TDMA for each subband b) b) Coarse-EMA algorithm: SDMA with $1 \leq L_n^0 \leq T$ or TDMA

Algorithm 1: Fine-EMA algorithm

1: Setup: allocate users based on $\pi(n) = U_n$, i.e.,conventional TDMA with OFDMA.
2: for n = 1 : N do
3: Compute L_n^0 from (15) for subband n.
4: EMA for subband n based on (16).
5: end for
6: Select either pure TDMA or fine EMA.

D.COARSE EMA ALGORITHM

To find EMA algorithm for the whole subband and to reduce the complexity of EMA system. We consider a coarse-EMA algorithm that selects either pure TDMA or SDMA for the whole subband. The total PC of SDMA for all subbands is defined from (10) as

$$f(\{L_n\}) = C\sum_{n\in N} L_n\sigma^2\left(2^{\frac{R}{L_n}}\Omega - 1\right)\|W_n\|_F^2 + \max\{L_n P_{fix}\} \quad (18)$$

the optimal $\{L_n^*\}$ can be found The optimal L_n that minimize (15) are identical to one another,
i.e $L_n^* = L^*$, $\forall_u \in N$.
The example of the coarse-EMA method is illustrated in Fig. 1(b). The coarse EMA is relevant to the case when the TPI term is dominant compared to the TPD term. This is because all SDMA slots over N take the same number of slots, which can reduce adaptively the dominant TPI term. Poor EE is, however, expected if the TPD term is dominant when Pfix is small because the coarse allocation loses a chance that reduces the dominant TPD term of a particular subband by using TDMA.

Algorithm 2: Coarse-EMA algorithm

1: Setup: the same as the setup in Algorithm 1.
2: Find L^0 from (15)
3: Select either TDMA or SDMA based on(16)

5. Proposed EMA Algorithm

Recently User association namely associating a user with a particular serving base station (BS), substantially affects the network performance, for ex LTE &5G network[10].We proposed the new algorithm of this greedy-based user assignment algorithms for the EMA system is to Maximize Energy Efficiency and reduces the complexity of the OFDMA systems. The proposed system work polynomial-complex and greedy-based user assignment algorithms for the EMA system. By conducting complexity analysis and energy efficiency comparison. We verify that the proposed algorithms can significantly improve energy efficiency with practically tractable complexity a greedy-over-UA (GUA) algorithm and a greedy-over-user-and-subband assignment (GUSA) algorithm. Design of EE user assignment greedy algorithms SDMA –OFDMA Energy Efficient Multiple Access schemes is considered.

1. GREEDY-OVER-UA (GUA) ALGORITHM

GUA algorithm that selects |Un| users in a greedy manner for a given subband n.for the EE of tractable complexity analysis purpose GUA algorithm that selects either a low-complex-yet-low-performance according to system capability and requirements. The greedy-based methods require polynomial complexity over the number of users or subbands.

Algorithm 1 GUA Algorithm

---

1. setup: U = {1, . . . ,U} and Un = ∅, ∀n ∈N = {1, . . . , N}.

2. for n = 1 : N

3. for $i_n = 1 : [U/N] + \grave{i}_n$

4. $\delta in ,u* = \min_{u \in u} \Delta i_n , u$, $U_{in}=U_{in}$ {u∗} and U = U \ {u∗}
5. end for end for

The GUA algorithm is summarized in Algorithm 1, where $i`_n$ =0 for all n except n = N, and $i`_N$ is determined such that N [U/N] + $i`_n$ = U. By associating the same number of users with each subband (except the last subband N), the GUA algorithm satisfies the constraints. To analyze computational complexity order of GUA Algorithm to obtain a norm of a 1-by- m complex valued vector is 4m. The Golub-Reinsch singular value decomposition (SVD) computational complexity of an m-by-n real-valued matrix is $4m^2n + 8mn^2 + 9n^3$, and for a complex-valued matrix, the computational complexity increases approximately four to six times.

2. GREEDY-OVER-UA (GUSA) ALGORITHM

We consider a GUSA algorithm in which both the user and subband are associated in a greedily for Maximize EE of tractable complexity analysis purpose For further performance improvement, a high-complex-with-high-performance select GUSA algorithm according to system capability and requirements. A Performance improvement and complexity increase are expected compared to Algorithm 1.

Algorithm 2 GUSA Algorithm

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1. setup: U = {1, . . . ,U} and Un = ∅,
 ∀n ∈ N = {1, . . . , N}.
2. while U = ∅
3. while N = ∅
4. for n ∈ N do δn,u∗ = $\min_{u \in u} \Delta_{nu}$ end for
5. n∗ = $\arg\min_{n \in N}$ {δ_n, u∗},
 $U_n * = U_n * \cup \{u*\}$,
6. U = U \ {u∗}, and N = N \ {n∗}.
7. end while
 N = {1, . . . , min{N, |U|}}.
 end while

The procedure in lines 6 and 7 of Algorithm 2 associates users fairly over the subbands & UN times computation of the 1-by-M vector norm. The same number of users are associated with each subband, except the last associated subband. The computational complexity order of the GUSA algorithm is approximated by ($32 M^3 U^2/3+8 U^4/3/M^2+16 U^3/3$) .

6. Numerical Results

In simulation MIMO channel capacity of OFDMA system is used. The easiest form of PSK is BPSK modulation is used. It used for high-speed data transfer application also it is widely used as a non-linear modulation scheme. In proposed simulation result analysis Massive MIMO and Small Cells technique is used to Improving Energy Efficiency & Zero forcing based multiuser MIMO precoding scheme of SNR. Results shows that proposed EMA algorithms of User assignment Greedy algorithms maximized the energy efficiency for the OFDMA systems as compare to previous optimal & fine EMA algorithm improve the Average EEs over with target rate R using Energy Efficient Multiple Access (EMA) scheme for Multi-user MIMO OFDM system. Also by improving the signal strength, we have maximized the energy efficiency

We assume that the channel is Rayleigh fading with zero mean and unit variance, i.e., hum ∼ CN(0, 1). For the transmit antenna correlation, we apply a correlation matrix with a correlation factor 0.3 [10]. A noise variance is defined such that each received antenna achieves 20 dB SNR, i.e., $\sigma^2 = 0.01$.The overall bandwidth is 10MHz. We set the overhead PC parameter as C = 5.26.

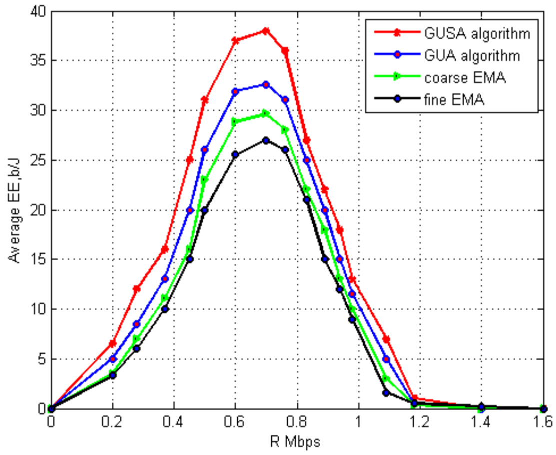

Figure 4.1: average EEs verses with RMbps

In fig 4.1 to compare the proposed EMA algorithms with the optimal EMA strategy, We evaluate for EE small-size system with M = T = 3 and N = 4. In Figure 4.1 shows the graph of average EEs verses with target rate R . Near-optimal number of SDMA time slots is derived. With the help of this strategy, We proposed User assignment Greedy algorithms this system. Again We improved the energy efficiency as well as strengthening the signal strength. The target rate is given in R Mbps is Mbits per second, and the Average Energy Efficiency is in bits/Joule. The X-axis denotes the R Mbps which varies from And the Y-axis shows the Average Energy Efficiency values of that are vary from 0 to 40. The proposed system is obtained using the User assignment algorithms for Energy Efficient Multiple Access (EMA) scheme for Multi-user MIMO OFDM system to Maximize EE. This system is the best as compare to all other systems in the literature. The comparison between Greedy User assignment algorithms for EMA system and optimal fine & coarse EMA algorithm is shown in Figure 4.1. Shows EE improvement compared to optimal EMA algorithm as see in proposed GUSA (greedy-over-user-and-subband assignment (GUSA) algorithm) can further maximize the EE & complexity increase. Then also GUA algorithm can improve EE compared to fine EMA algorithm. GUSA algorithm requires greater complexity than a GUA algorithm As proposed greedy user assignment (GUSA) algorithm better EE than previous one. As studied previously fine and coarse-EMA algorithms reduce significantly the complexity of optimal strategy from At the same time as shown in the optimality loss is negligible for various Pfix.

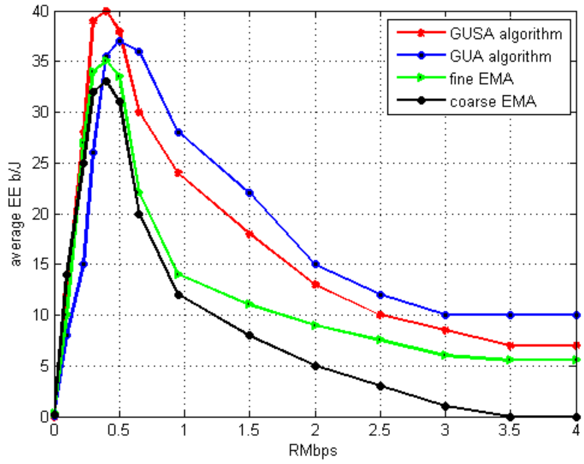

Figure 4.2: average EEs verses with RMbps

In Figs. 4.2, We show that Average EEs over pfix with R= 1Mbps. the EE of a larger-size system with M = 20, T = 20, N = 30, and U = 600. The SDMA is an EE-aware SDMA that selects only SDMA with all subbands of a large number of users. EE is evaluated over R with Pfix = 45dBm . SDMA is preferable as the target rate R increases. as target rate R increases then the complexity of greedy over user assignment subband algorithm (GUSA & GUA) as is to improve EEs as compare to fine &coarse EMA algorithm.

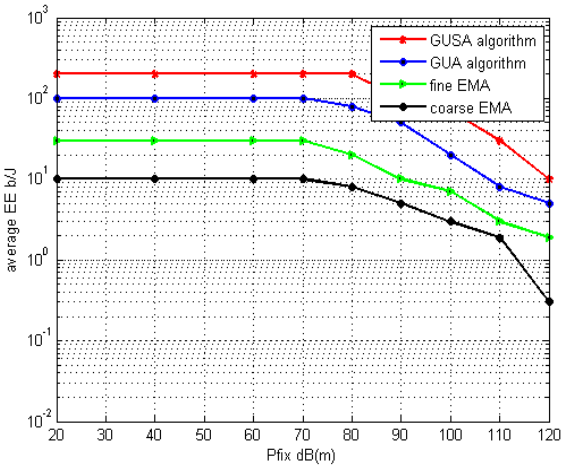

Figure 4.3: average EEs verses with Pfixdbm

In this Figure 4.3 shows that Average EEs over pfix with R= 1Mbps it is clear that, Coarse EMA algorithm having poor EE is due to transmit power independent on subband then power consumption is high (when Pfix is small). But using the SDMA is preferable if the TPI term is dominant and proposed greedy over user assignment subband algorithm (GUSA & GUA) as is to improve EEs then at particular pfix it will decrease results than previous one. At last it is shown that our proposed system EE improvement of GUSA algorithm compared to Fine EMA is marginal.

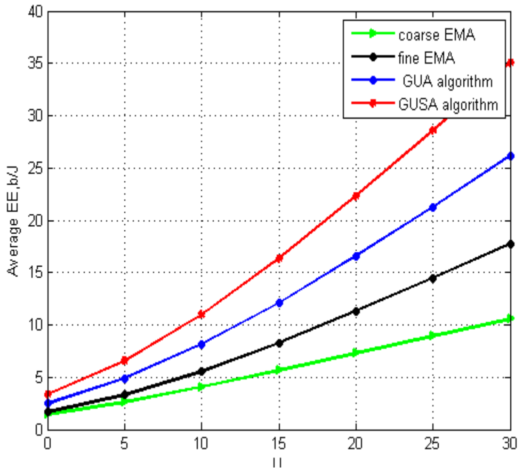

Figure 4.4: average EEs verses with U (large no of users)

In this Figure 4.4 shows that Average EEs over Number of users as it is shows EEs over with Pfix=45dbm. As it has SDMA time slots have derived for large No users it selects SDMA as singular values of multiuser MIMO channel matrix has larger SDMA time slots no of subbands for all user MA that achieves higher EE of propsed greedy based user assignment algorithm(GUA &GUSA) algorithm maximum EE improvement and increase with computational complexity with practically tractable complexity compare to fine &coarse EMA algorithm have worst EE to the greedy algorithm.and also by improving the signal strength having the best results such as higher EE of the OFDMA system than other techniques of the previous work in the literature.

7. Conclusion

In this paper, User Assignment algorithms for Energy Efficient multiple access (EMA) method for Multiuser MIMO–OFDMA system has been proposed. Based on polynomial-complex and greedy-based Algorithms called GUA & GUSA Algorithms for the EMA system that maximize EE with computational complexity gets increased than Fine EMA algorithm. Using the required power consumption of SDMA to achieve the fixed feasible target rates .the EE-aware EMA chooses either TDMA or SDMA for each subband. We have select EE-aware SDMA, near-optimal number of SDMA slots has been analytically derived. As SDMA is most selected

i) If the target rate is high

ii) If the transmit-power-independent power consumption is dominant

iii) if the channel quality is good as frequency and time resource allocation are uniquely mapped to one another.

Simple EMA algorithms, namely greedy over user assignment & subband GUA & GUSA, fine and coarse EMA Algorithms have been devised, and their impact on EE improvement has been verified by Matlab Simulation that proposed work provides to improve the energy efficiency of the OFDMA.

8. Future Work

To design an Extend Energy Efficiency aware Multiple access systems to improve the energy efficiency of MIMO–OFDMA System with further work consideration design technique is to be done in future work are follows :

ii) The uncertainty of channel state information,

ii) multiple-receive-antenna users,

iii) Power consumption of uplink communications,

iv) General multiuser EE maximization with inequality rate constraint and transmit power constraint.

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