Research Paper | Engineering

HIGH POWER-EFFICIENCY AND GOOD QOS FOR MIMO-OFDM IN MOBILE COMMUNICATIONS USING SVD

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ABSTRACT

The mobile multimedia communication systems have rapid development in the recent years. The main parameter is energy efficiency optimization and quality of service constraint for MIMO-OFDM communication. The various algorithm to be minimize the energy level for the transmitted signal. But it have some limitation. So we used proposed energy efficiency optimized power allocation (EEOPA).and to improve the energy efficiency for MIMO-OFDM mobile multimedia communication system. The EEOPA algorithm used to solve the problem of multi-channel optimize to multi target in single channel optimization. The method to calculate the channel characteristics using singular variable decomposition method (SVD).

For multiple input multi output orthogonal frequency-division multiplexing i.e. "MIMO-OFDM" mobile multimedia communication systems an energy-efficient model is first proposedconsidering statistical quality of service (QOS) constraints. Using the channel-matrix "SVD" method, all sub channels are classified by properties of the corresponding channel. The limitation of multichannel joint optimization in traditional MIMO-OFDM communication systems is converted into a single-channelmulti target optimization problem by sub channels grouping. hence, obtaining a closed-form solution for energy-optimization in "MIMO-OFDM" mobile multimedia communication systems.

KEYWORDS :

I. INTRODUCTION

With the rapid development in information and communication technology (ICT), the energy consumption problem of information and communication technology industry, accounts to about 2% of world-wide CO2 emissions every year and increases the electrical bills of network operators[1], drawing the attention. With the increase in demand for the energy efficiency in communication systems, various resource allocation optimization methods that enhance the energy efficiency have become popular in mobile multimedia communication systems, along with allocation of transmission power [2],[3], allocation of bandwidth[4]-[6],allocation of sub-channel [7]. The energy efficiency has become important study in Multinput multi output wireless communication systems in the previous works[8]–[14]. Poisson–Voronoi tessellation cellular networks with energy-efficiency with spatial distributions of power consumption and traffic load was proposed in [9]. The energy–bandwidth efficiency drawback in MIMO multi hop wireless networks along with the effects of antennas on the energy–bandwidth efficiency were analyzed in [10]. A closed-form solution for the tradeoff between spectral and energy efficiency in the multi input multi output Rayleigh fading channel by considering different types of power consumption models were analyzed in [11]. To investigate the tradeoff between spectral and energy efficiency inmulticella "relay cooperation scheme" was proposed [12]. The MIMO scheme attracts the greater attention of the researchers [13-16] in telecom domain to address various aspects SNR improvement and and also in the perspective of the quality of services.

The energy and spectral efficiency tradeoff of the uplink of a multiuser cellular virtual MIMO system with decode and forward-type protocols werereviewedin [17].Multiple-input–multiple-output techniques can construct parallel channels that are independent for the transmission of data streams, improving spectral efficiency and capacity of the system with no increase in the requirement of bandwidth. Orthogonal frequency-division multiplexing (OFDM) technologies avoid the multipath effect by converting frequency selective channels to flat ones. In mobile multimedia communication systemsthe MIMO-OFDM technologies are widely used. Improving energy efficiency along with quality of service constraint is an important problemin Multi input multi output-OFDM systems.

In interference forwarding and Relay-aided multicellforwarding relaying paradigms[18]" the tradeoff between spectral and energy efficiency was analyzed. Previous works explored the tradeoff betweenthe embodied power and operating powerpresent inthe infrastructure equipment of the manufacturing process [19].

Present studies worked on the joint pdf of eigenvalues of a "Wishart matrix"for measuring performance of the channelin Multi input multi outputcommunication systems. The Quality of service statistical exponent is constant as the impact of the average power constraint andeffective capacity on the energy efficiency. The energy efficiency degrades with the rise in the average power constraint, and for the rise in average power constraint, the effective capacity rises. For each sub channelaverage transmission power constraint 'P' is configured; the threshold of transmission power allocation corresponding to each sub channel should satisfy the following constraints:

As the transmission power increases, leadingto higher effective capacity, the utilization of energy of the system also increases;hence, the larger input power leads to in decrease in energy efficiency

In traditional Multi input multi output-OFDM communication systemsthe multichannel joint optimization drawback is converted to a single-channelmulti target optimization problem by sub channels grouping.

Enhancing energy efficiency with a quality of service constraint is a key problem in Multi input multi output-OFDM systems.

Few research worksthat address the problem of optimizing the energy efficiency with differentQuality of service constraints in Multi input multi output-OFDM systems were proposed.

Proposed system

Various channel models based on the "Wishart matrix theory" wereproposed in the previous works for Multi input multi output communication systems. Demand of different throughput levels with the corresponding quality of service in Multi input multi output communication systems, an efficient antenna assignment scheme and an access control scheme were proposed . A downlink QoS evaluation scheme was proposed for mobile users in **OFDMA** wireless cellular networks.With the effective capacity of the block fading channel scheme, a Quality of service driven power and rate adaptation method was proposed for mobile wireless networks. By combining information theory with the effective capacity, some Quality of service driven -driven power and rate adaptation methods were proposed for multiplexing and diversity systems.with the aim ofreducing the energy utilization, the important tradeoffs between energy efficiency and link-level metrics were studied for various wireless communication systems.

The merits of enhancing the energy efficiency and effective capacity of multi input multi output -OFDM systems using quality of service constraints are:

It is understood that, along with quality of service constraints, energy efficiency is also a major constraint for designing and evaluating communication systems.

The performance of high spectral efficiency Multi input multi output communication systems in a flat Rayleigh fading environment using multiple phase-shift keying signals was analyzed in terms of probabilities of symbol errors.

Simulation results show that multichannel communication systems can have high throughput and good Quality of service simultaneously because large values of 'θ' correspond to the more Quality of service requirements with less number of sub-channels being selected.

SYSTEM MODEL:

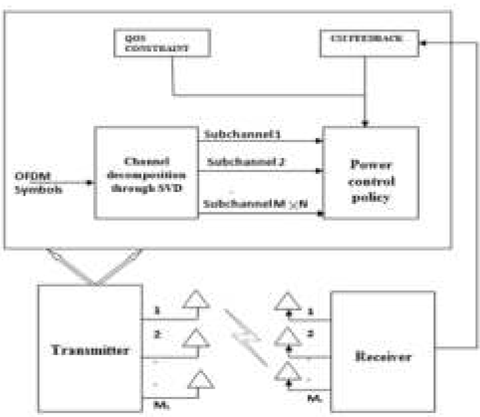

FIG 1: MIMO-OFDM system model

The MIMO-OFDM mobile multimedia communication sys-tem is shown in Fig. 1. It has an Mr × Mt matrix antenna, N subcarriers, and S OFDM symbols, where Mt is the number of transmit antennas, and Mr is the number of receive antennas, the system bandwidth is denoted as B and the frame duration as Tf. The OFDM signals are assumed transmitted within frame duration. Then, the received signal of the MIMO-OFDM communication system can be expressed as follows:

$$y_k[i] = H_k x_k[i] + n \;\ldots\ldots\ldots\ldots\ldots(1)$$

Here $y_k[i]$ and $x_k[i]$ are the received and transmitted signal vector at the k^{th} (k = 1, 2, ... , N) subcarrier of the i^{th} (i = 1, 2, . . . , S) OFDM symbol, respectively.H_k is the frequency-domain channel matrix at the kth subcarrier, and n is the additive noise vector. Let C denote the complex space; then, we have $y_k \in C^{Mr}$, $x_k \in C^{Mt}$, $H_k \in C^{Mr\times Mt}$, and $n \in C^{Mr}$. Without loss of generality, we assume $E\{nn^H\} = I^{Mr\times Mr}$, where E{.} denotes the expectation operator.

ALGORITHM DESIGN:
Algorithm 1 EEOPA.
Input: $M_t, M_r, N, H_k,$ $, B, T_f, \theta;$

Initialization: Decompose the MIMO-OFDM channel ma-trixH_k(k = 1, 2, . . . , N) into M × N space–frequency sub-channels through the SVD method.

Begin:
1) Sort sub-channel gains of each subcarrier in decreasing order as follows: $\bar{P}$

$\lambda_1, k \geq \lambda_{2,k} \geq \cdots \geq \lambda_{M,k}$ (k = 1, 2, . . . , N). (21)

2) Assign λ_n, 1, λ_n, 2, . . . , λ_n, N from all N subcarriers into the nth-group sub-channel set as follows:

Group_n = {λ_n, 1, λ_n, 2, . . . , λ_n, N }, n = 1, 2, . . . , M. (22)

3) for n = 1 : M do
Calculate the optimized transmission power-allocation threshold Λn for Group_n

according to the average power constraint as follows:

$$\int_{\Lambda_n}^{\infty}\left(\frac{1}{\Lambda_n^{\frac{1}{\beta+1}}\lambda^{\frac{\beta}{\beta+1}}} - \frac{1}{\lambda}\right)P\Gamma_{m,k}(\lambda)d\lambda \leq \bar{P} ..(7)$$

Execute the optimized transmission power-allocation policy for Group_n as follows:

$$\mu_{opt\_n}(\theta,\lambda) = \begin{cases} \frac{1}{\Lambda_n^{\frac{1}{\beta+1}}\lambda^{\frac{\beta}{\beta+1}}} - \frac{1}{\lambda} & ,\lambda \geq \Lambda_n \\ 0 & ,\lambda < \Lambda_n \end{cases} ..(8)$$

Calculate the optimized effective capacity for Group_n: as follows:

$$(\theta)_{opt\_n} = -\frac{N}{\theta}\log\left(\int_0^{\infty} e^{-\theta T_f B \log_2\left(1+\mu_{opt\_n}(\theta,\lambda)\lambda\right)} P\Gamma_{m,k}(\lambda)d\lambda\right)..(9)$$

end for
4) Calculate the optimized energy efficiency of the MIMO-OFDM mobile multimedia communication system as fol-lows:

$$\eta_{opt} = -\frac{1}{\theta\times\bar{P}\times M}\sum_{n=1}^{M}\log\times\left(\int_0^{\infty} e^{-\theta T_f B \log_2\left(1+\mu_{opt\_n}(\theta,\lambda)\lambda\right)} P\Gamma_{m,k}(\lambda)d\lambda\right) ..(10)$$

end Begin

Output :

IV. PERFORMANCE ANALYSIS :
The conventional average power allocation i.e. APA algorithm, where every sub-channel with the same transmission power is compared with the proposed EEOPA algorithm in below figures.Different antenna numbers in three typical scenarios are configured

1) $M_t = 2$ and $M_r = 2$
2) $M_t = 3$ and $M_r = 2$
3) $M_t = 4$ aΛ_n , η_{opt}

In Figure 7, the effect of the Quality of service statistical exponent'θ' on the energy efficiency of the two algorithms is analyzed considering constant average power

P = 0.1 W.

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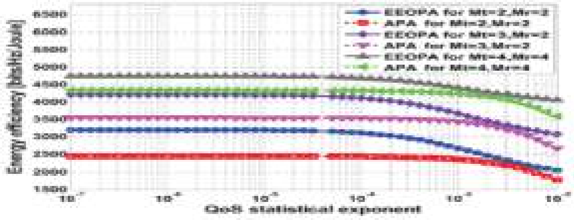

Fig. 7. Energy efficiency η of the EEOPA and APA algorithms as variation of QoS statistical exponent θ under different scenarios.

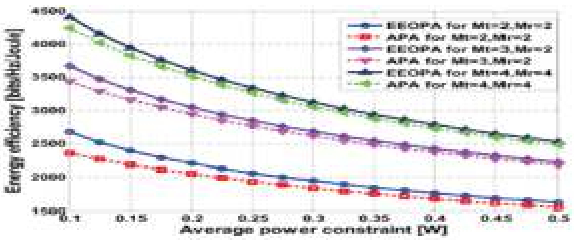

Fig. 8. Energy efficiency η of the EEOPA and APA algorithms as variation of average power constraint P under different scenarios.

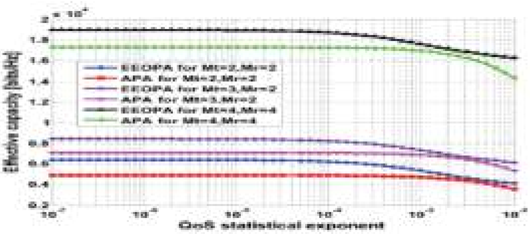

Fig. 9. Effective capacity $C_{total}(\theta)$ of the EEOPA and APA algorithms as variation of QoS statistical exponent θ under different scenarios.

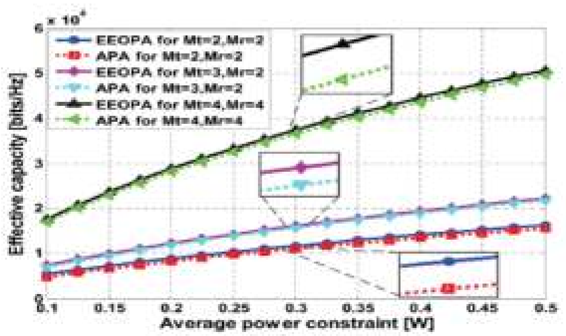

Fig. 10. Effective capacity $C_{total}(\theta)$ of the EEOPA and APA algorithms as variation of average power constraint P under different scenarios.

$\theta = 10^{-3}$. By taking into account the changes in average power constraint, the energy efficiency of the proposed EEOPA algorithm is always higher than the traditional APA algorithm. In Figure. 9, the effect of'θ' on the effective capacity of the two algorithms is compared using constant average power P = 0.1 W. with changes of 'θ', the effective capacity of the EEOPA algorithm is more than the effective capacity of the otheralgorithm. The effect of average power constraint on the effective capacity of the algorithms is caluculated in figure.10 with the fixed value of $\theta = 10^{-3}$. From these comparitive results,the proposed algorithm i.e.energy efficiency optimized power allocation improves the energy efficiency and effective capacity of multi input multi output-OFDM systems.

V. CONCLUSION:

An energy efficienct scheme is proposed for Multi input multi output-OFDM multimedia communication systems with statistical Quality of service constraints. An optimization scheme with energy efficiency is proposed that rely on the sub-channel grouping technique, simplifying the complex optimization problem to a simplified single channel optimization problem. A closed-form method of the energy-efficiency optimization is obtained for Multi input multi output –OFDM multimedia systems. Moreover, a novel algorithm, i.e., EEOPA, is constructed to enhance the energy efficiency of Multi input multi output-OFDMsystems. simulation results show the proposed EEOPA algorithm enhances the energy efficiency and effective capacity of Multi input multi output -OFDM multimedia communication systems with quality of service constraints compared to traditional APA algorithms.

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