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A Research on Spectrum Allocation Using Optimal Power in Downlink Wireless system

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Abstract- *A resource Allocation Problem for spectrum sharing in wireless communication system. Using multi-input multi-output orthogonal frequency division multiple (MIMO-OFDM) is a very promising technology for enhancing the flexibility and efficiency of cellular and future communication systems. A joint optimization problem for resource allocation is solved by a combine scheme of multiple-input multiple-output with orthogonal frequency division multiple (MIMO-OFDM) and used for broadband wireless applications. The energy efficiency is also key parameter in designing and evaluating communication system. we can address the assignment of subcarriers and power allocation to all users to optimize the sum of user average data rates, total available transmitted power, and proportionality among users, subcarriers. We propose an algorithm that process subcarrier and power allocation simultaneously under data rate constraint. Computationally efficient water filling algorithm for multiuser OFDM. This algorithm is based on the multiuser water filling theorem and determines the subcarrier allocation for a multiple access OFDM system, The presented iterative algorithm performs well, also with a high number of sub channels.*

Key Words: Multiple-input–multiple-output(MIMO),Power allocation, water-filling algorithm, Resource allocation.

1.INTRODUCTION

Next generation wireless network target ubiquitous high data rates, efficient resource (eg. Spectrum and Power) usage and economical network deployment given the fact that radio spectrum becoming a scare resource in wireless communication system. With the ever increasing demand for higher reliable data transmission and various quality-of-service requirements for emerging mobile services and applications such as content sharing and video streaming, mobile multimedia communications are expected to be provided in a more effective and efficient way. From the wireless communications perspective, channel variation and interference also challenge system robustness. The Orthogonal Frequency Division Multiple Access (OFDMA)has been Proposed as a state of the art air interference technology to enable high spectrum efficiency and effectively combat Frequency selective fading. First the subcarrier allocation algorithms assign the assign the subcarrier to the users, We concentrate on the subcarrier allocation based on the multiuser water filling theorem. This maximizes the total bit rat under the constraint of a maximum transmission power per user. The fundamental challenge of resource allocation lies in the scarcity of the available spectrum, the expansive servicing area, and the large user number. As a result, the same frequency spectrum needs to often be reused in multiple geographical areas or cells [1].

2. THEORY OF BACKGROUND

In[2]. energy-efficient and fair resource allocation is investigated in a downlink OFDM-based mobile communication system. Given a subcarrier assignment, the bisection-based optimal power allocation (BOPA) is proposed at first, which achieves the maximum EE and guarantees proportional data rates for users. Then, a two-step subcarrier assignment is designed to avoid unaffordable computational complexity of exhaustive search. In the first step, the estimated energy-efficient transmit power is found via the assumptions on flat fading and subcarrier sharing. In the second step, the traditional spectral-efficient subcarrier assignment (SESA) is introduced to complete the bandwidth resource allocation among users. Although the two-step subcarrier assignment is suboptimal due to the fact that the optimization is done independently in two separate steps, numerical results demonstrate that its performance is very close to the optimum. This paper energy-efficient solution and the traditional spectral-efficient policy and observes that they are similar with each other in the low channel-gain-to-noise ratio (CNR) regime.

In[3] this paper, we address the assignment of subcarriers and power to all users to optimize the sum of user average data rates subject to constraints on signal to noise ratio, total available transmitted power, and proportionality among users, subcarriers. We compare the proposed rate adaptive scheme that maximizes the average data rate of multiuser multi input multi output orthogonal frequency division multiplexing (MU MIMO-OFDM) systems with others conversional schemes. The total power allocation scheme for MU OFDM system is proposed on convex optimization environment. In a rate adaptive resource-allocation scheme, which includes adaptive power distribution, subcarrier allocation according to instantaneous channel conditions, is proposed for multiuser MIMO-OFDM system.Simulation results show the large performance improvement of proposed rate adaptive scheme over other adaptive and fixed allocation schemes.

The work in [4], an adaptive resource allocation methodology is proposed for cellular orthogonal frequency division multiplexing systems in a multiuser environment. The proposed method is featured as a low-complexity algorithm that involves not only adaptive modulation, but also adaptive multiple-access control and cell selection. Specifically, a multiuser subcarrier-and-bit loading scheme is developed to maximize the spectral efficiency. Besides, a dynamic cell selection scheme is proposed to deal with the problem of overloading and no uniform traffic density. Numerical results show that the presented algorithm offers significant improvement in spectral efficiency due to the successful exploitation of channel variation, multiuser diversity, and inter-cell diversity. In[5], a comprehensive resource allocation scheme has been proposed for downlink multi-cell OFDMA networks. The scheme includes radio resource and power allocations, which are implemented separately to address the formulated problem with reduced complexity. The optimal solution is obtained by the Lagrange method and The simulation results show that the proposed scheme can achieve significant performance improvement for cell-edge users and desirable performance for cell-centre users compared with the reference schemes Problems in above methods Presented wireless communication system are required to support a variety of high speed data communication services for its uses, such as video streaming and cloud based services. A limited amount of resources,i.e,power and bandwidth are available at the transmitter, Rate adaption achieves higher goodput by combating channel variability, which is common to all wireless communication system due to factors such as fading mobility and multiuser interference due to number of user increases system also scalable. In some of the paper they use complex algorithm for cellular wireless system which is hard to understand and implement.

3.. PROPOSED METHOD

Step-1.Water Filling Algorithm Model: The process of water filling algorithm is similar to pouring the water in the vessel. The unshaded portion of the graph represents the inverse of the power gain of a specific channel. The Shadow portion represents the power allocated or the water. The total amount on water filled (power allocated) is proportional to the Signal to Noise Ratio of channel As shown in the following formula Power allocated

$$\frac{Pt+\sum_{i=1}^{n}\frac{1}{Hi}}{\sum Channel}-\frac{1}{Hi} \quad (1)$$

Where Pt is the power udget of MIMO system which is allocated among the different channels and H is the channel matrix of system. The capacity of a MIMO is the algebraic sum of the capacities of all channels and given by the formula below. Capacity=

$$\sum_{i=1}^{n}\log_{10}(1+\text{Powerallocated} * H) \quad (2)$$

We have to maximize the total number of bits to be transported .As per the scheme following steps are followed to carry out the water filling algorithm. Algorithm Steps:-

1. Take the inverse of the channel gains. 2. Water filling has non uniform step structure due to the inverse of the channel gain. 3. Initially take the sum of the total power Pt and the inverse of the channel gain. It gives the complete area in the water filling and inverse power gain

$$Pt+\sum_{i=1}^{n}\frac{1}{Hi} \quad (3)$$

4. Decide the initial water level by the formul given below by taking the average power allocated

$$\frac{Pt+\sum_{i=1}^{n}\frac{1}{Hi}}{\sum Channel} \quad (4)$$

5. The power values of each subchannel are calculated by subtracting the inverse channel gain of each channel.

$$\frac{Pt+\sum_{i=1}^{n}\frac{1}{Hi}}{\sum Channel}-\frac{1}{Hi} \quad (5)$$

In case the power allocated value become negative stop iteration.

Step-2 Subcarrier Reallocation: The subcarrier allocation solution from Step 1 does not guarantee the fulfillment of every user's rate constraints in(5). Therefore, the initial solution needs to be adjusted so that more subcarriers are allocated to the users whose minimum rate constraints have not been satisfied yet. To achieve an optimum feasible solution in the end, the following conditions must be satisfied during the reallocation process.

1) A subcarrier that was originally assigned to user k_n^*cannot be reallocated too their users if there allocation will cause the violation of user 's k_n^* data rate requirement. That is, if. $R_{k_{n'}^*} - c_{k_n^* n} < r_{k_n^*}$. 2) Each subcarrier reallocation should cause the least reduction in the overall throughput.

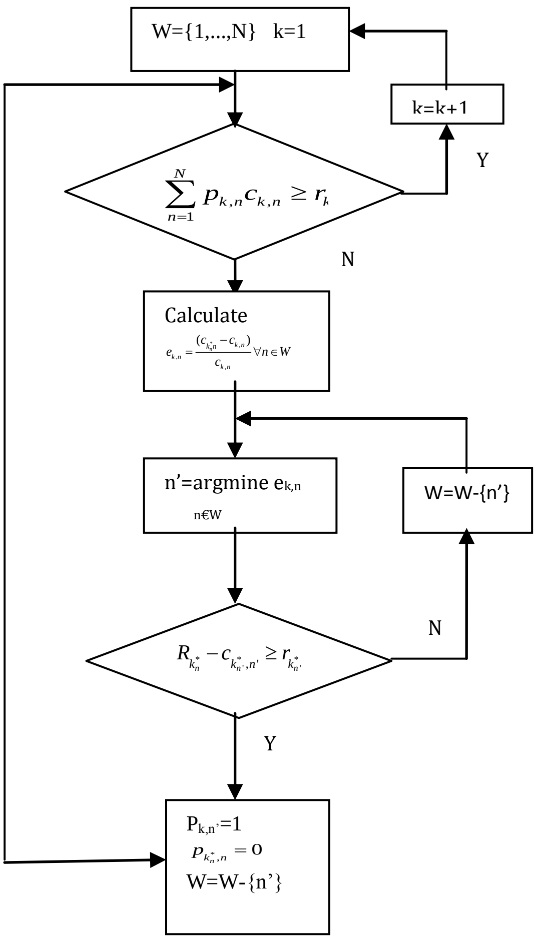

Fig. 1: Subcarrier reallocation

3) The number of reallocation operations should be kept as low as possible. The first condition ensures that the number of satisfied constraints increases monotonically in the subcarrier reallocation process, so that the number of reallocation operations is finite and divergence is avoided. Conditions 2 and 3 can be realized by letting

$$e_{K,N} = \frac{(c_{k_n^*,n} - c_{k,n})}{c_{k,n}} \quad (6)$$

Be the cost function of reallocating subcarrier to user instead of the originally assigned user .Such function is proportional to the decrease in the overall throughput, and inversely proportional to the increase of the data rate of user which affects the number of reallocation operations.

Subcarrier reallocation is carried out on a user-by-user basis for all users whose rate constraints have not been satisfied in Step 1. Consider user k for example. In each stage, the subcarrier with the lowest cost function, denoted by n' , is selected.n' will be allocated to user k , if this reallocation does not cause $R_{k_{n'}^*} - c_{k_n^* n} < r_{k_n^*}$,Otherwise, it will not be reallocated, and a new n' will then be identified from the rest of the subcarriers. This subcarrier reallocation process repeats for user k until its data rate requirement is satisfied. The detailed algorithm is depicted in Fig. 2. In the figure, A-B denotes the set difference operation of set A and B, which produces a new set $\{x | x \in A \& x \nexists B\}$ Likewise, W denotes the set of subcarriers that can be selected for reallocation. Subcarrier reallocation is equally important in Power Allocation So using Proposed algorithm for allocation.

3. Simulation Results

In this section, the performance of the power allocation as shown in fig 1.First of all, we assume some parameters after that we allocated spectrum using Proposed algorithm due to optimal spectrum allocation we find capacity ,Hear we assume system for user =5

Table -1: Simulation Parameters Multiuser Dynamic Allocation

Target BER	10^{-4}
Noise Spectral Density	1
Number of Users	5
Number of Subchannels	16
Rate Reuirement	23bits/sec/Hz
Fading environment	Rayleigh Fading

Total Power	1W
Bandwidhth	1MHz

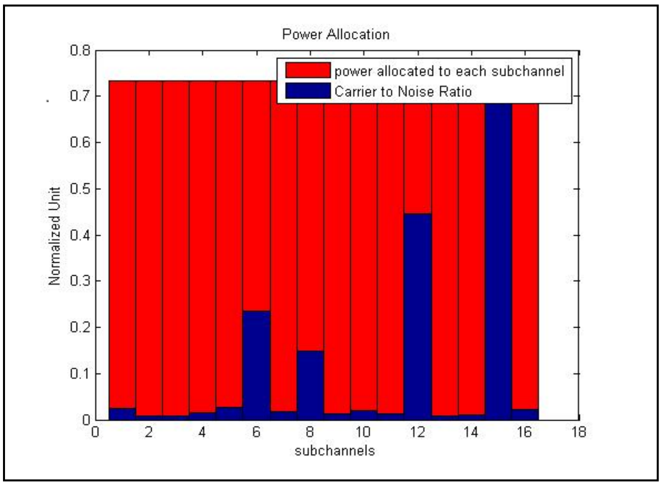

Fig.2: Water Filling Algorithm Model

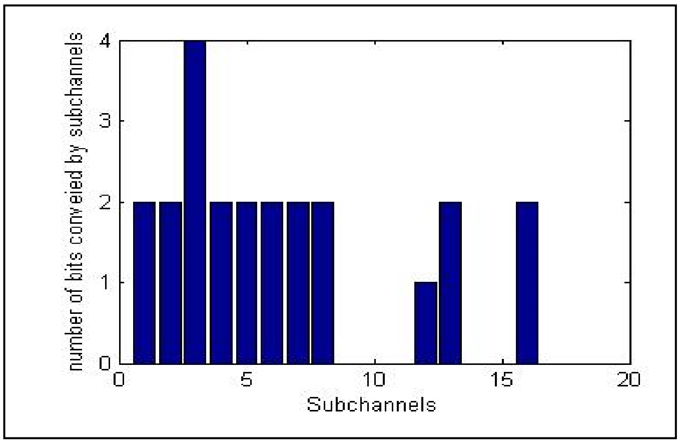

Fig -3: Resulting bit allocation after subcarrier and bit allocation.

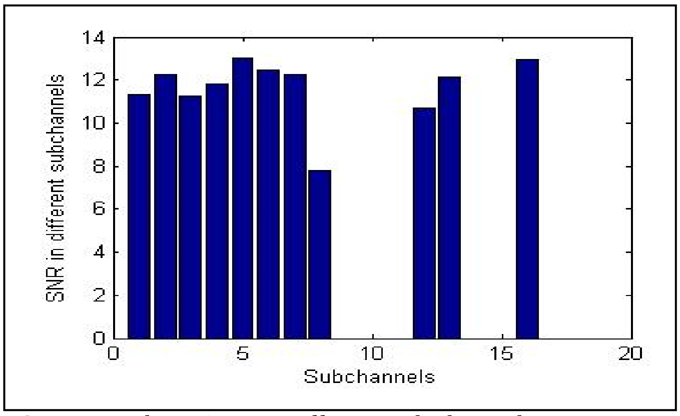

Fig -4: Resulting SNR in Different sub channel.

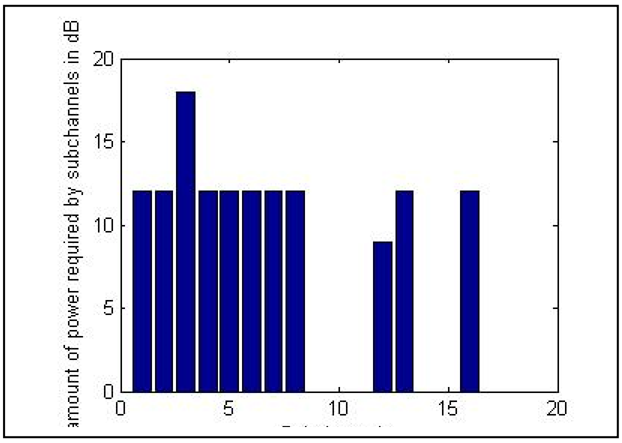

Fig -5: Amount of power required by subchannel after reallocation.

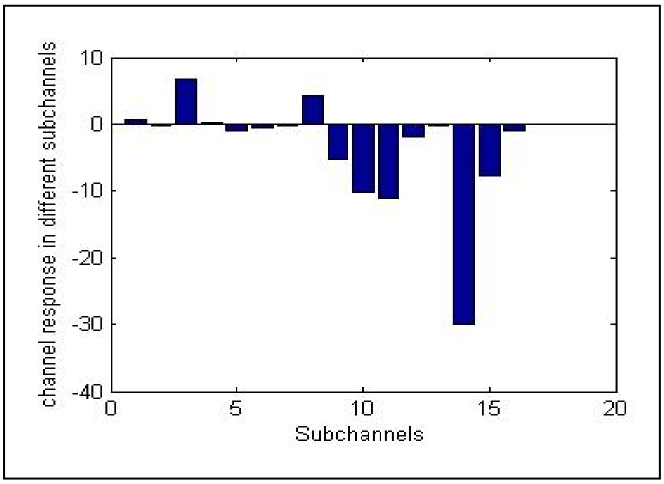

Fig -6: Reallocated Channel response in different sub channels

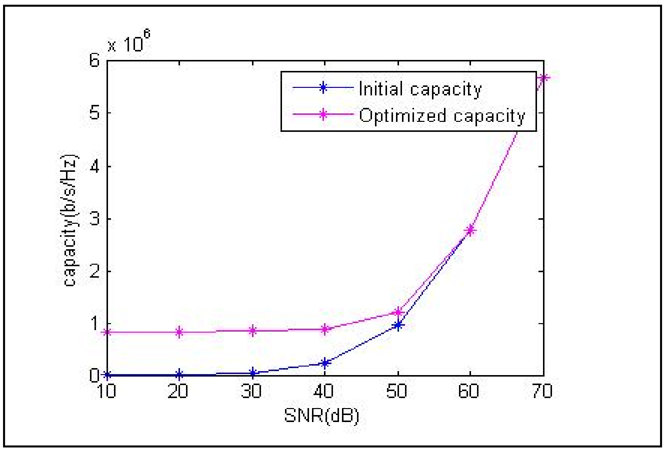

Fig -7 Using MIMO-OFDM we get optimized capacity of *N* = 16 subchannel and *U* = 5 users.

3. CONCLUSIONS

In this paper, we have presented the MIMO OFDM model using MATLAB. The results of simulation form the model will enable the researches to choose water filling algorithm for their requirements. MIMO has helped to ISI problem. The Results indicates that the Capacity is enhanced significantly by transmitting the different stream of data through different antennas at same frequency. The water filling algorithm allocates the more power to subcarrier for that noise level is high. Capacity is increased with increase in number of antenna also we get result from power allocation we assign subchannel for efficient spectrum by using Proposed Algorithm which allocate more subchannel and remove noise.

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REFERENCES

[1] Ronald Y. Chang and Zhifeng Tao" Multicell OFDMA Downlink Resource Allocation Using a Graphic Framework" IEEE Trans. Vehicular Techno ,vol. 58, no. 7, pp. 3494-3507, Sep 2009.

[2] Zhanyang Ren, Shanzhi Chen, Bo Hu, and Weiguo Ma "Energy-Efficient Resource Allocation in Downlink OFDM Wireless Systems With Proportional Rate Constraints" IEEE Trans. Vehicular Techno , vol. 63, no. 5, pp. 2139-2150 June 2014.

[3] Dushyant Kumar Tiwari and Manish Trivedi "An Efficient Subcarrier and Power Allocation Scheme for Multiuser MIMO-OFDM System" International Journal of Recent Development in Engg. and Techno. vol. 2, pp32-39, March 2014.

[4] Ying Jun Zhang and Khaled Ben "Multiuser Adaptive Subcarrier-and-Bit Allocation With Adaptive Cell Selection for OFDM Systems"IEEE Trans. Wireless Communications, vol. 3, no. 5, pp.1566-1575,Sept. 2004

[5] Yiwei Yu, Eryk Dutkiewicz, Xiaojing Huang, and Markus Mueck"Downlink Resource Allocation for Next Generation Wireless Networks with Inter-Cell Interference" IEEE Trans. On Wireless communication, vol. 12, no. 4, pp 1783-1793, April 2013

[6] W. Rhee and J.M. Cioffi, "Increase in capacity of multiuser OFDM system using dynamic Subchannel allocation," in *Proc. IEEE Vehicular Technology Conf.*, Tokyo, Japan, May 2000, pp. 1085-109.

[7] A. Gorokhov, *et al.*, "Receive antenna selection for MIMO spatial multiplexing: theory and algorithms,"*Signal Processing, IEEE Transactions on,* vol. 51, pp.2796-2807, 2005

[8] H. Bolcskei, "MIMO-OFDM wireless systems: basics, perspectives, and challenges," *Wireless Communications,IEEE,* vol. 13, pp. 31-37, 2006.

[9]C.Y.Wong,R.S.Cheng,K.B.Letaief,andR.D.Murch,"Multiuser OFDM with adaptive subcarrier ,bit, and power allocation, "IEEE J.Sel. Areas commun. vol.17, no.10 pp.1747-1758,oct. 1999