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Optimising Bit Error Rate and Power Consumption Through Systematic Approach for OFDM Systems

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Abstract: Orthogonal Frequency Division Multiple Access (OFDMA) is becoming a widely deployed mechanism in broadband wireless networks due to its capability to combat the channel impairments and support high data rate. The Proposed System considers the Resource Allocation and Distributed Power Allocation Scheduling with Greedy Search Method in the downlink of OFDMA networks supporting Distributed Antenna System. The purpose of Resource Allocation is to allocate sub-carriers and power to users to meet their service requirements, while maintaining fairness among users and maximizes resource utilization. To achieve these objectives, utility-based Resource Allocation schemes along with Resource Allocation paradigms such as power control, adaptive modulation and coding, sub-carrier assignment and scheduling are adopted. On one hand, a utility-based Resource Allocation scheme improves resource utilization by allocating enough resources based on user's Quality of Service (QoS) satisfaction. On the other hand, Resource Allocation based on utilities is non-trivial when users demand different traffic types with convex and non-convex utilities. The proposed scheme efficiently schedules users by exploiting multiuser diversity gain, OFDMA Resource Allocation flexibility and utility fair service discipline.

Keywords: OFDMA, QoS, DAS, MS's.

1. INTRODUCTION

This dissertation discusses the evaluation of Resource Allocation and Distributed Power Allocation scheduling in the downlink of OFDMA (Orthogonal Frequency Division Multiplexing Access) systems. In order to establish the context and need for the work undertaken, it is necessary to discuss the fundamental concepts behind the work. This paper brings out the need for Resource Allocation and power allocation in OFDMA systems. It also discusses the introduction about OFDMA characteristics of a mobile communication channel.

1.1 OVERVIEW

The Distributed Antenna System (DAS) has been proposed for future wireless communication systems due to its advantages of increased capacity, extended coverage and improved link reliability. In DAS, Remote Access Units (RAUs) are geographically separated and are connected to a baseband processing unit via optical fibers. Thus, the DAS can reduce access distance, transmit power and co channel interference, which can improve system performance, particularly for those mobile stations (MSs) near the edge of a cell.

2. PROPOSED SYSTEM

The proposed architecture accepts the networking parameters as input which contains the MATLAB simulation where the novel Resource Allocation algorithm is applied to the numerical dataset. The overall architecture follows an automatic allocation for OFDMA from the start to end state.

2.1 MODULES LIST

1. Channel Modeling
2. Resource Allocation
3. Greedy Search Channel Estimation
4. Distributed Power Allocation Algorithm

2.1.1 Simulation Parameters

An optimal approach to Jointly Optimize channel Rate and dynamic Power Consumption with Greedy Search Power Allocation Algorithm for OFDMA Systems simulation Parameters is described in table 1.

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Table 1: Simulation Parameters

Initial Parameters	Value Assigned
Number of Primary Users (PUs)	10~30
Number of Channels (CH)	10~15
Number of subcarriers	64
Required bit error rate	10^{-3}
Total Space (Simulation)	-log(5*BER)/1.6
Total Power	20 dBm
Bandwidth	1 MHz
Bad Power	1.1565
Amplitude	40
Channel modeling length	6

3. OFDMA SYNCHRONIZATION

This OFDMA synchronization shows a method for digital communication with OFDMA synchronization based upon the IEEE 802.11a standard. System objects from the Communication System Toolbox are utilized to provide OFDMA modulation and demodulation and help synchronization functionality. In particular, this example illustrates methods to address real-world wireless communication issues like carrier frequency recovery, timing recovery and frequency domain equalization.

The IEEE 802.11a standard describes the transmission of an OFDMA modulated signal for information exchange between systems in local and metropolitan area networks. This example utilizes the physical layer outlined by that standard, specifically the preamble symbols and the OFDMA grid structure.
The purpose of this example can be explained as:

➢ To model a general OFDMA wireless communication system that successfully recovers messages, which also corrupted by various simulated channel impairments.

4. OFDMA SIMULATION

Since MATLAB has a built-in function "ifft ()" which performs Inverse Fast Fourier Transform, IFFT is opted for the development of this simulation. Six m-files are written to develop this MATLAB program of OFDMA simulation. One of them is the main program script file, which is the only file that needs to be run, while other m-files will be invoked accordingly. A 256-grayscale bitmap image is required as the source input. Another bitmap image file will be generated at the end of the simulation as the output.

Three MATLAB data storage files (err_calc.mat, OFDMA_parameters.mat, and received.mat) are generated during the simulation. err_calc.mat is to archive the baseband data before the transmission and be retrieved at the end of the simulation for the purpose of error calculations. OFDMA_parameters.mat is to archive the parameters initialized at the beginning of the simulation and reserve them for the receiver to use later. In the reality, the receiver would always have these parameters; in this simulation, these parameters are configured by the user at the beginning, so they are passed to the receiver by OFDMA_parameters.mat as if being preset in the receiver.

5. SOFTWARE IMPLEMENTATION

The OFDMA iterative sub-channel and power allocation of total capacities between the proposed method sub-gradient and Energy Efficient power allocation is efficiently implemented. The implementation effects capacity to increase as the number of users increases. This is the effect of multiuser diversity gain, which is more prominent in systems with larger number of users. The proposed method has a consistently higher total capacity than the sub-gradient power allocation method for all the numbers of users for this set of simulation parameters. This advantage can be attributed to the relaxation of the proportionality constraints and the added freedom of assigning the N* subcarriers. To formulate a Resource Allocation problem with finite queue backlogs over multiple time slots for the downlink of an OFDMA-based distributed network. This is a non-linear problem with integer variables and thus very difficult to solve in general. We propose an iterative procedure to solve it exactly using a commercial integer program solver. This will allow us to validate our search method. For implementation, i.e., to compute the allocation in a time significantly lower than the duration of a channel, it can be develop a family of optimal search method that offers different tradeoffs

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in terms of speed and efficiency. We show that our optimal Energy efficiency method perform well in terms of time and efficiency.

6. EXPERIMENTAL RESULTS

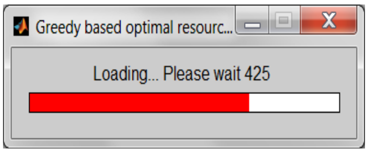

Fig.1 Wait bar Process

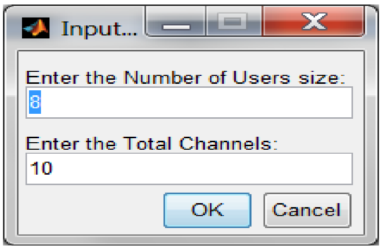

Fig.2 Initializes Number of Users and Channels

This fig.2 shows that the input initialization of number of users and number of channels to be used.

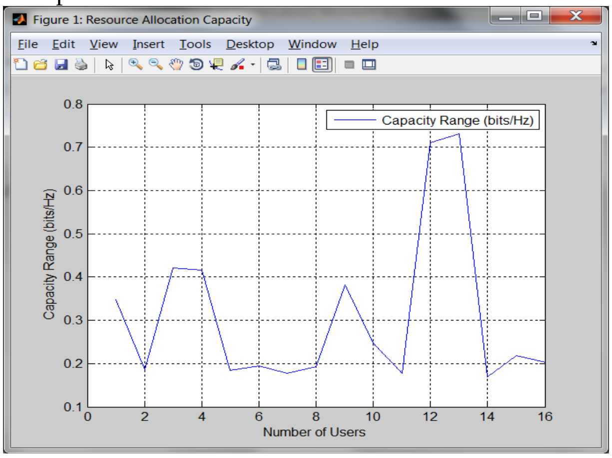

Fig.3 Resource Allocation Capacity

This fig.3 shows the initialization of all the variables. It keeps track of the capacity for each user and N is the set of unallocated subcarriers.

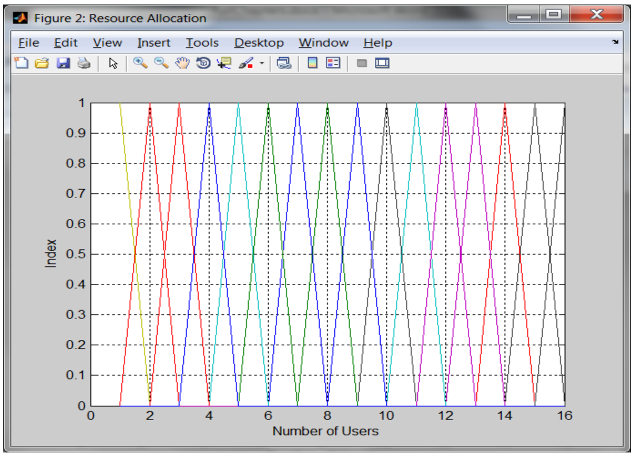

Fig. 4 Resource Allocation Index Variation

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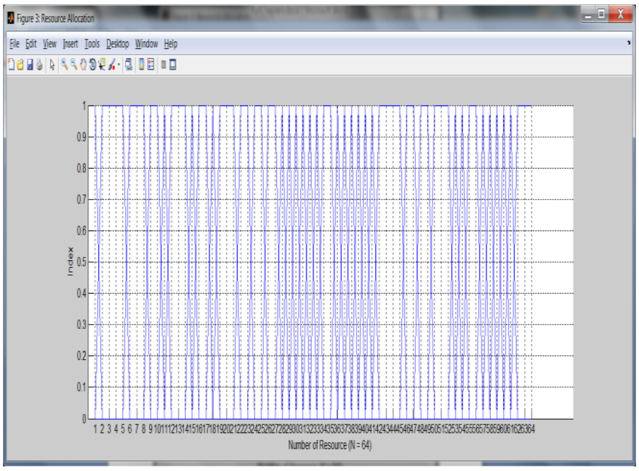

Fig.5 Number of Resource Allocation (N = 64)

This fig.5 shows that it assigns unallocated subcarrier to each user which has the maximum gain for that user.

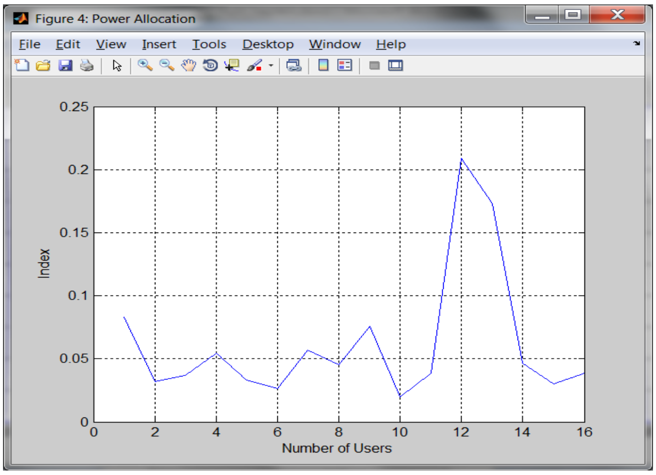

Fig.6 Transmit Power Allocation capacity

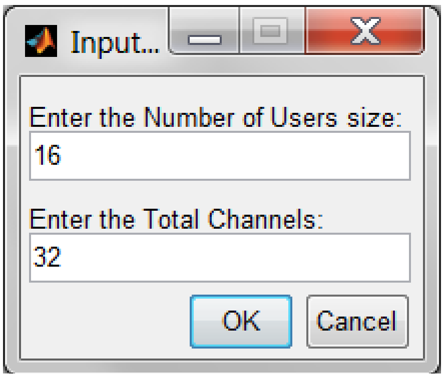

Fig.7 Initializes Number of Users (16) and Channels (32)

This fig.7 shows that the input initialization of number of users with 32 number of channels.

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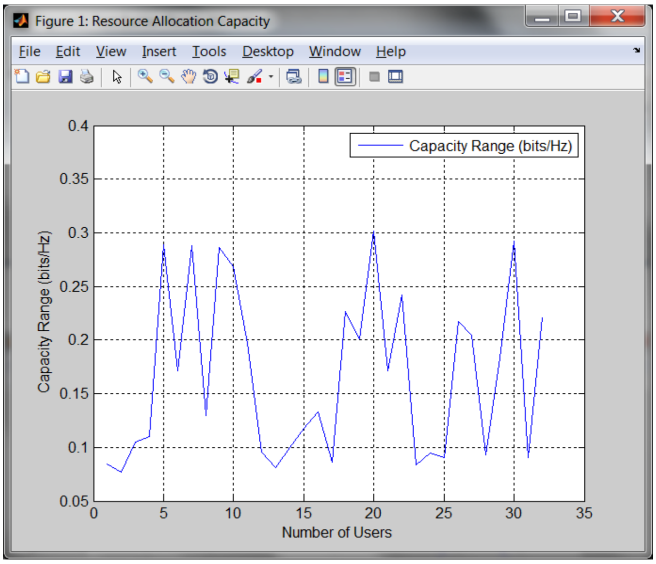

Fig.8 Resource Allocation Capacity of 32 users

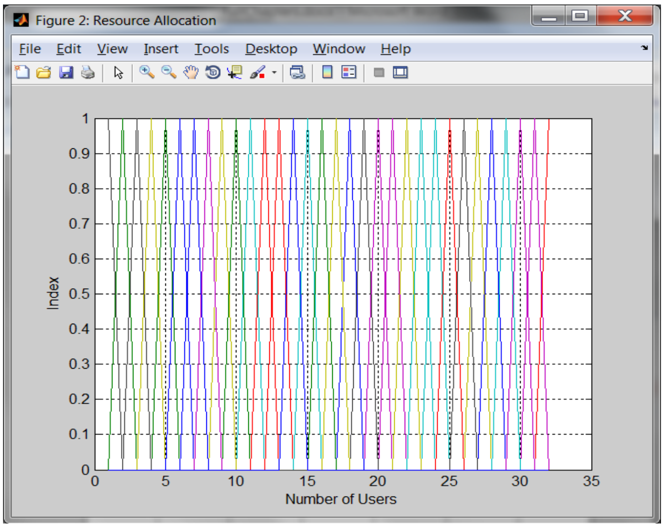

Fig.9 Resource Allocation Index Variation of User size = 32

This fig.9 shows that the user that needs a subcarrier mostly. It is iterated to choose the best subcarrier.

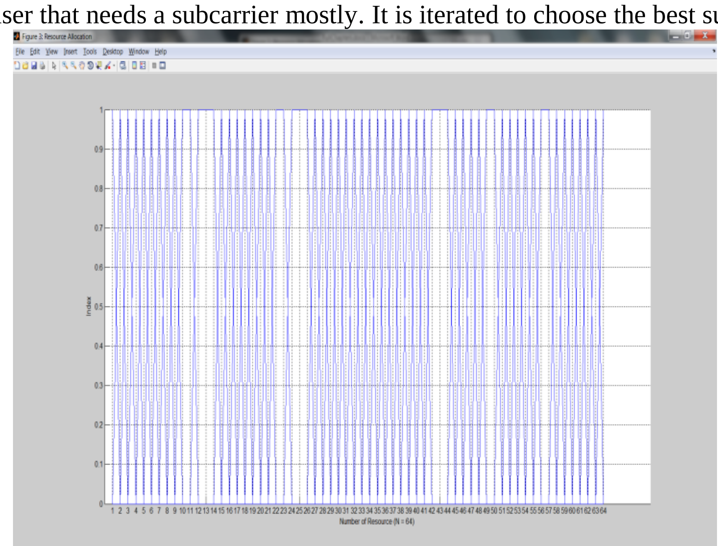

Fig.10 Number of Resource Allocation (N = 64)

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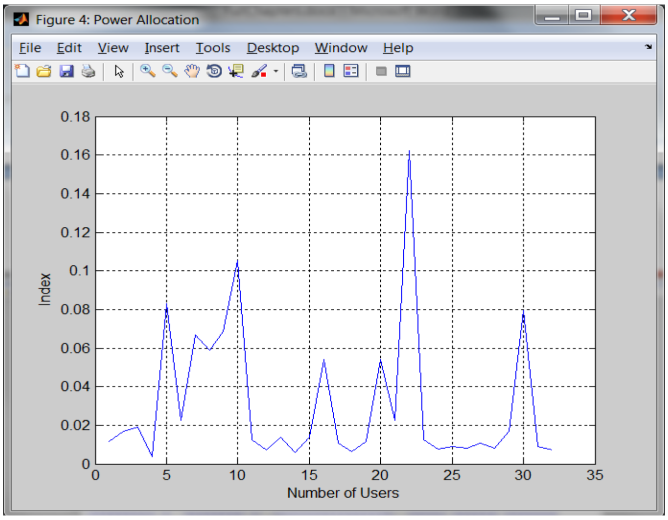

Fig.11 Transmit Power Allocation capacity of User size = 32

This fig.11 shows the Transmit power allocation for 32 number of users with index variation.

7. PERFORMANCE EVALUATION

The proposed system work performed the experiments on a prostate gene expression micro array dataset. The performance evaluation consider the Bit Error Rate (BER) per subcarrier resulting from the proposed algorithm to solve optimization problem using Greedy search optimization for different channel realizations for γ_{av}= 30 dB[7] and $\alpha = 0.5$. As can be seen, the resulting BER per subcarrier fluctuates around 10^{-4} and hence, the approximation optimization problem is an acceptable reformulation for searching method. Additionally, the value of the achieved average BER is included in Table 2 to validate the effectiveness of the proposed algorithm to maintain the target BER threshold of 10^{-4}.

Table 2 BER per subcarrier allocation of Greedy algorithm for random channel realizations at $\alpha = 0.1$ and $\gamma_{av} = 30$ dB.

Number of Sub-carrier	Genetic Algorithm	Proposed Greedy Algorithm
10	4.512	**3.12**
20	3.45	**3.32**
30	3.94	**2.14**
40	3.75	**3.55**
60	3.017	**1.17**
50	4.48	**4.28**

In Table 3 represents the BER per subcarrier allocation of Greedy algorithm for random channel realizations at $\alpha = 0.2$ and $\gamma_{av} = 30$ dB.

Table 3 BER per subcarrier allocation of Greedy algorithm for random channel realizations at $\alpha = 0.2$ and $\gamma_{av} = 30$ dB.

Number of Sub-carrier	Genetic Algorithm	Proposed Greedy Algorithm
10	5.57	**5.14**
20	5.10	**4.87**
30	5.39	**5.05**
40	4.06	**3.14**
50	3.02	**2.39**
60	4.66	**2.11**

Table 4 BER per subcarrier allocation of Greedy algorithm for random channel realizations at $\alpha = 0.3$ and $\gamma_{av} = 30$ dB.

Number of Sub-carrier	Genetic Algorithm	Proposed Greedy Algorithm
10	4.54	**4.27**
20	6.21	**5.47**
30	5.08	**4.11**
40	3.12	**3.47**
50	4.112	**3.83**
60	4.53	**3.92**

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8. CONCLUSION

This Proposed system presents an enhanced method such as Greedy based optimal Resource Allocation and power allocation in OFDMA-based distributed networks (GROFDMA) which combines average BER and throughput to solve the optimization problem during data transmission. In the GROFDMA model, a novel Energy Efficiency Resource Allocation and Power allocation scheme that achieves approximate rate proportionality, while maximizing the total capacity is obtained. The proposed technique that iteratively computes the optimal solution with the help of a commercial integer program solves. A greedy based search algorithm for the joint allocation of sub-channels and power allocation in the downlink of an OFDMA-based distributed antennas system able to exploit the special linear case, thus allowing the optimal power allocation to be performed using a direct algorithm with a much lower complexity comparing to the existing genetic search algorithm.

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