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Sub-Channel allocation in the MC-CDMA systems for Throughput Maximization – A Survey

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ABSTRACT: Efficient Channel allocation is one of the important problem in the latest generation mobile communication systems. A very high data rate is most wanted for the usage of multimedia and Internet, So in this paper surveys the performance of Adaptive Channel Allocation (ACA) algorithm and allocates the channels to users for high data rates in the downlink transmission of MC-CDMA systems. For the analysis autoregressive model of correlated Rayleigh fading processes is used. Performance of the ACA algorithm is evaluated with MRC,EGC,ZFC combining schemes.

KEYWORDS : MC-CDMA, ACA,BER, THROUGHPUT.

I.INTRODUCTION

In this paper spectrum allocation technique for MC-CDMA system is evaluated for the long time evolution and Rayleigh fading channel is used for the evaluation. The targets for downlink set to 1Gbit/s and uplink data rate requirements were set to 500Mbit/s. Previously throughput technique is maximized by improved algorithm [1]. Majorly channel fading is not same for different subcarriers so that feature has been developed for allocating the subcarriers to the users according to the instantaneous channel state information (CSI) in [1] and [2]. From the reference [2] ACA is proposed for maximizing throughput in which subchannels are divided into groups , these groups are allocated depending upon the user requirement. And in that paper channel fading feature is not fully developed.

In [3] other subcarrier selection techniques are discussed by dividing the spectrum allocation techniques by two ways that is single channel allocation and group channel allocation. In [5] selected number of sub carriers is assigned to each user. In this paper the concept is to assign each user only as many sub-carriers as are needed to support the user's data rate. For addition of every filters for subcarrier selection the complexity of the system increases. Channel state information refers to amount of channel fading user experiences on particular channel. Some schemes have been proposed for sub carrier selection according to CSI which includes, selecting the sub carrier requiring least amount of transmit power on it. In this paper how to require least amount of transmit power is required for selecting a subcarrier is discussed.

For improvement in BER performance, high data throughput in a multi-cell environment, reducing the consume high power at the mobile terminal , and results in high spectrum efficiency these results must shown by an appropriate sub-carrier selection technique.

For the given power, throughput can be maximized by assigning maximum number of sub carriers to the users. The investigation method of sub channel allocation to the user for the given transmit power in the downlink transmission is done and from the CSI each user will require a different transmit power on each channel, using this characteristic group of channels will be allotted to users. In the existing method of group allocation to the users has been modified which will result in producing with ACA algorithm[2].

II. FORMULATION OF MAXIMIZING THROUGHPUT

Proper use of channels and transmit power to maximize the throughput. In the downlink transmission of multiuser MC-CDMA technique for the given transmit power at the base station maximum possible number of channels should be allocated to the users to maximize throughput maintaining low BER. If the required amount of transmit power of each

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channel has been determined for all users before the channel allocation, then throughput maximization problem is given by a following

optimization of c_g^u problem as [2],

$$\max \sum_{u=1}^{U} \sum_{g=1}^{G} c_g^u$$

Where

c_g^u - number of the uth user's channels on the gth group.

U – Total number of users

G - Total number of groups of subcarriers.

Problem (1) is subject to

$$\sum_{u=1}^{U} \operatorname{sgn}(c_g^u) \leq 1, \qquad \forall u, g$$

$$\sum_{u=1}^{U} \sum_{g=1}^{G} c_g^u$$

$$c_g^u \in \{0,1, \ldots\ldots, S\}, \quad \forall u, g$$

Where

S – Total number of subcarriers in gth group.

Above equation (1.b) is the total transmit power constraint.

where

PT max - The maximum transmit power, and

p_g^u- The required transmit power for uth user on one channel of the gth group,it is expressed as,

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$$p_g^u = \beta N_o S^{-2} \sum_{s=1}^{S} \left|\omega_{g,s}^u\right|^2 \sum_{s=1}^{S} \left|\omega_{g,s}^u f_{g,s}^u\right|^{-2}$$

β- Target threshold of BER.
$f_{g,s}^u$ – uth user's channel fading on the sth subcarrier of the desired group
$\omega_{g,s}^u$ - uth user's frequency domain combining weight for the signal on the sth subcarrier of the desired group.
Therefore the problem of throughput maximization can be put forward as, Every user experiences different fading on different channels and consequently user requires different transmit power on different channels. For the given system we have to form groups of neighbouring channels and then these groups are allocated to the users according to the transmit power requirement.

III. SUB CHANNEL SELECTION ALGORITHM

An improved algorithm is proposed in [7] for the channel allocation in the downlink transmission of multi-user MC-CDMA systems for throughput maximization, under the constraints that the total transmit power should not exceed the maximum transmit power and each channel's SINR should not be less than a pre-defined value.

In this algorithm a sub channel group assignment technique is suggested as follows,

3.1 Criteria used for group allocation

In this scheme, the group of sub channels are allocated to the different users by,

1) Calculating required transmit power for the users on one channel of all groups.
2) While allocating groups to the users, all the G number of groups will scan all the U number of users at the same time and the user requiring minimum transit power calculated as per improved algorithm allocated that group.
3) Next remaining(G-1) number of groups will scan all the remaining (U-1) number of users and so on……

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The improved algorithm [1] is as follows,

Initialization

$P_R = P_T^{max}, C = \{1,2, \dots, G\}, c_g^u = 0$ for

$u = 1, \dots, U$ and $g = 1, \dots, G$.

Group assignment

while $C \neq \emptyset$

$u = 1:U$

$g = 1:G$

$[p_{min}, u_{gmin}] = \min(\min\{p_g^u\})$ % allocate a group to user requiring least power on one channel of that group

end

Channel allocation

while $C \neq \emptyset$

$t = \arg\min_{\forall g \in C}\left\{p_g^{u_{gmin}}\right\}$; % select the group with lowest power requirement

$c_t^{u_{tmin}} = \min\left(\left\lfloor \frac{P_R}{p_t^{\mu_{tmin}}} \right\rfloor, S\right)$; % calculate the available channel number

$P_R = P_R - c_t^{\mu_{tmin}} p_t^{\mu_{tmin}}$; % calculate the residual transmit power

$C = C \setminus \{u_{tmin}\}$;

If $c_t^{\mu_{tmin}} = 0$ % since the residual transmit power is not enough , terminate channel allocation.

Break the loop;

End If

End While

Different combining schemes will result in different power allocation, accordingly required transmit power (p_m^k) will change.Frequency domain combining weights for MRC, EGC and ZFC scheme are as per Table1 . Therefore throughput will be different for different combining schemes

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TABLE I
IV.SURVEY REPORT

SI NO	TITLE	YEAR	POINTS PUT FORTH	CONCLUSION.
1	Multicarrier CDMA with adaptive frequency hoping for mobile radio systems	1996	They were proposed a water filling algorithm, it was motivated by the water filling (WF) principle in information theory	They were improved the speed and average SINR of the system
2	Adaptive Modulation based MC-CDMA Systems for 4G wireless consumer applications.	2003	They were combined subcarrier selections techniques with adaptive modulation techniques	They were improved the data rate and modulation scheme changes with change in number of users satisfying the BER requirement.
3	A proposal of sub-carrier selecting MC-CDMA system for 4G systems.	2005	They were assigned each user a selected number of sub carriers in the SCS-MC-CDMA system.	They counter the problem of high power consumption in the sub-carrier selection.
4	A proposal of sub-carrier selecting MC-CDMA system for 4G systems"	2007	They were assigned each user a selected number of sub carriers in the SCS-MC-CDMA system.	They counter the problem of high power consumption in the sub-carrier selection.
5	Adaptive channel and power allocation of downlink multi-user MC-CDMA systems	2009	They proposed ACA algorithm for maximizing throughput in which the sub channels are divided into groups	They showed the further way to saving the power and higher throughput in the MC-CDMA systems.
6	A Review of sub-carrier selection techniques employed in MC-CDMA systems for 4G Networks	2012	They discussed about various sub carrier selection techniques.	They divided the spectrum allocation techniques in two broad categories. 1) Single channel allocation 2) group channel allocation.
7	Improved Algorithm for Throughput maximization in MC-CDMA	2012	They proposed a Improved algorithm for the maximized throughput in the MC-CDMA systems	They given an adaptive group assignment technique such that the available power at the base station will be utilized efficiently and maximum number of channels will be allocated to the users.

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V. CONCLUSION

In this paper the evaluation of the performance of the improved algorithm for sub carrier allocation is done. Rayleigh fading channel model is considered. The proposed algorithm suggest an adaptive group assignment technique that will result in the optimum utilization of the available transmit power at the base station for allocating maximum number of channels to the users. The further improvement in the throughput is one of the emerging fields paving the way to more researches.

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