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An Efficient Technique for Sub-Carrier Group Allocation over Hybrid MC CDMA

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Abstract: Now a days the wireless communication plays an important role in various fields such as business, entertainment, information processing, etc. There are various methods of modulation schemes which are used to send and receive the data to or from the base station and mobile stations. The 4G wireless communications are used in various applications such as multimedia, live streaming, video conferencing, mobile TV and so on. The OFDMA (Orthogonal Frequency Division Multiple-Access) techniques are used to support multiple users who can communicate with the single base station to improve the throughput. MIMO (Multiple Input Multiple Output) is a technique which is used to satisfy the demand of the wireless communication system. The channels are allocated to the user for efficient communication between base station and mobile stations. The channel with minimum transmission power has been assigned to the user from the channel list. Suppose the requested channel is not available which leads a performance problem then the channels are maintained as a group. The proposed technique maintains a group of channel in an increasing order. Suppose the channel unavailability occur it will select a suitable channel from the group. If the requested channel is not available in the group it will automatically select a channel from the other group which decreased the signal to noise ratio in the communication. It also uses various algorithms like channel and group estimation, channel assignment and alignment which improve the throughput over the wireless communication. The adaptive technique also implemented to assign and align the channel to the requested users. In future the throughput will be improved by using an efficient technique.

Key words: MC-CDMA, OFDMA, sub-carrier allocation, throughput, 4G technology

INTRODUCTION

Wireless communication is a technique which is used to transfer the information between two or more devices that are not connected. The devices that can be used for communication are radios, cellular telephones and wireless networking and so on. Wireless communications can be used over radio frequency, microwave communication, Infrared (IR). The selection of these modes is based on the coverage on the communication (i.e.) long-range or short-range communication (Kwack *et al*., 2007). There are various protocol used for allocating the channels to the multiple users namely Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access (CDMA). In FDMA all users can able to share the satellite simultaneously each for one user which transmits in a single frequency. TDMA allows multiple users can able to share the single frequency channel with different time slots. CDMA allows multiple transmitters to send and receive the information simultaneously by using single channel. Orthogonal Frequency Division Multiplexing (OFDM) is a technique for reliable and high-rate data transmission over wireless channels by dividing the bandwidth into several orthogonal narrowband sub carriers which are allocated to the multiple users. These techniques are used in the wireless communication in order to achieve high throughput in the data transmission (Kwack *et al*., 2007). A single cell with a Base Station (BS) uses over multiple access scheme in order to transmit data to multiple users for accessing channels. The BS and the users are varied in time and frequency. The subcarriers are allocated to various users in a single system by using different priority functions in order to provide QoS without degradation. This technique is not suitable for multiple antenna systems (Pandharipande *et al*., 2004).

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The sub-carrier-paring based resource allocation in OFDMA-based two-way relay networks by implementing an efficient algorithm and also improve the system performance in maximum level (Zhang *et al*., 2012). The available subcarriers are grouped together for allocating the channels to the users (Hamdi, 2012). The subcarrier and bit allocation algorithms are introduced to achieve the QoS between the users. The priority approach is also used to allocate the sub-carrier whenever there is an unavailability of sub-carriers which leads the computational complexity. The random priority approach is not suitable for the effective communication, so the modified order priority approach could be implemented for improving throughput in the communication (Soares *et al*., 2012). Four sub-carrier allocation algorithms are analyzed namely coordinated, sequential, random and an innovative which uses both random and coordinated subcarrier allocation. The random-coordinated algorithm is used to achieve the higher system capacity when compared to the other algorithms over less transmitting power (Stiakogiannakis *et al*., 2008). Sub-carrier pair based resource allocation is used to optimize the power allocation, sub-carrier pairing, sub-carrier pair to relay assignment for maximize the system transmission rate over total network power constraint (Dang *et al*., 2010). An efficient sub carrier and bit allocation scheme are used to search a best solution without searching a full channel. The ant colony optimization is also introduced to resolve the issues in wireless network design by reducing the power consumption with high efficiency (Song and Kim, 2011). Orthogonal Frequency Division Multiplexing (OFDM) with unicasting for multiple Base Stations (BSs) are studied to restrict each user with one BS, i.e., each sub-carrier is assigned to only one user. The hybrid approach has been introduced for improving the performance of the BS selection and sub-carrier selection by using the iterative method (Liu *et al*., 2011). The BER and quality of services to the users can be implemented using dynamic resource allocation based OFDMA systems with less complexity and better performance (Vadivel and Ranganathan, 2012). The existing techniques are focused on the BER and the performance over OFDMA Systems can be achieved the high throughput for allocating the channels to the multiple users. The proposed technique also focuses on the performance related to the throughput but also with availability and reliability. The channels are formed as a group in an increasing order in order to select the minimum transmission power to satisfy the users. Suppose the requested channel is not available in one group it can search it in some other group to satisfy the users without any service delay and unavailability.

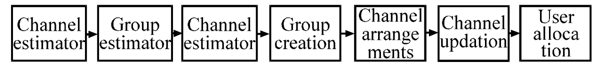

Fig. 1: Block diagram of the proposed system

BLOCK DIAGRAM OF THE PROPOSED SYSTEM

Figure 1 describes that the block diagram of the proposed technique. The channel estimator selects the total number of channel which is assigned to the user. The group estimator determines the number of group for the channels. Channel selection selects the channel which has minimum transmission power. Group creation creates the group for all the channels. Channel arrangement is used to arrange the channel in sorted order for further process. Suppose the requested channel is not available in the group, channel updating section is used to select the channel from other group or other neighboring cells. User allocation section allocates the channel to the requesting user.

FLOW DIAGRAM OF THE PROPOSED SYSTEM

Figure 2 describes that the overall flow of the proposed system. In MC-CDMA, the channels are allocated to the requesting users which are selected from the group. Initially the total numbers of channels are determined, i.e., N_C determine the group capacity called N_G. The channel is selected according to the transmission power level of each channel then forms a group which holds the entire channel from the channel list. The group has selected from the total number of group N_G. If the group not exceeds the maximum number of group G_{MAX} then select the next channel from the channel list and place it into the group and so on. Once the group has been created successfully then sorts the channels in the group then only the minimum transmission power is selected for assigning to the requested user. If the size of the requested user is less than the number of group, checks the available channel then allocate the channels to the users. If the channels are not available then selects from the other group or from neighboring cells. Suppose the number of requesting user is more than the total number of group then it selects from the next available group. Finally the channels are allocated to the requesting users. The proposed technique selects and updates the channel whenever the channel goes unavailable and also improves the reliability in the channel allocation to the user.

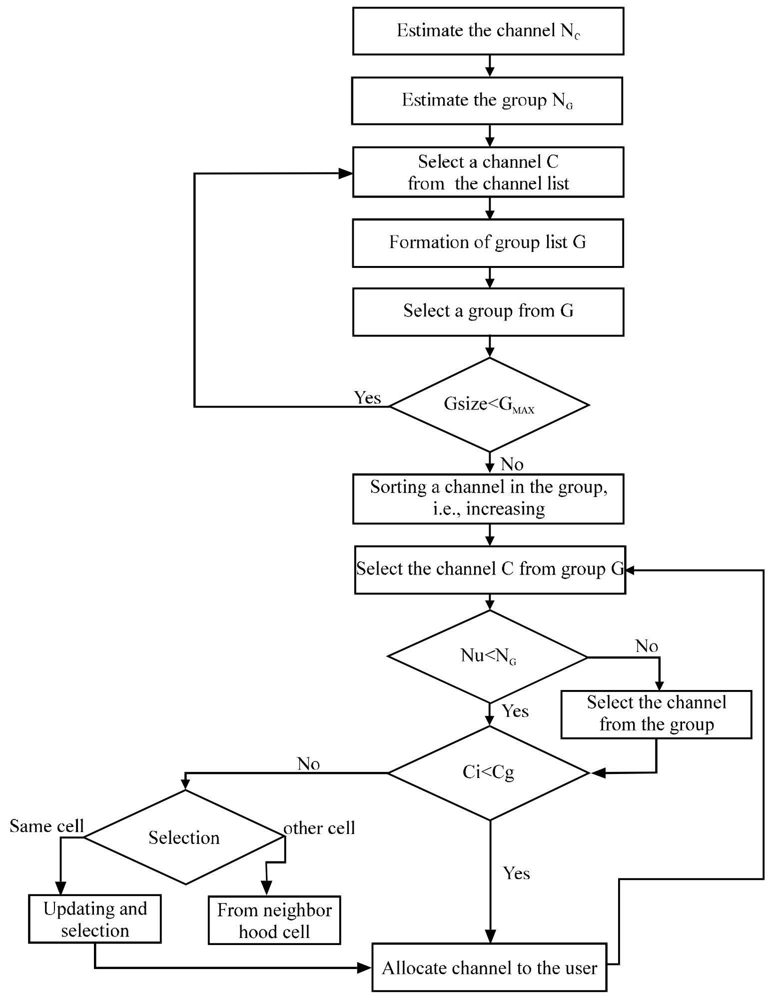

Fig. 2: Flow diagram of the proposed system

LEMMAS OF THE PROPOSED SYSTEM

Lemma 1: The transmission power is always less than the threshold:

$$\text{Power level} = \begin{Bmatrix} \text{best} & PT \le PT\min \\ \text{worst} & PT \ge PT\min \\ 0 & \text{otherwisr} \end{Bmatrix}$$

Lemma 2: The group has all the channels in the available channel list:

$$\bigcup_{i=1}^{k} Ci, \quad Ci \in C$$

Lemma 3: The active channel group always hold the available channel which are allocated to the user:

$$\text{Active channel group} = \begin{Bmatrix} \{G \leftarrow Ci\} & \text{if } \{PT \le PT\text{level}\} \text{ and } Ci \in C \\ 0 & \text{otherwise} \end{Bmatrix}$$

Lemma 4: The passive channel are maintained in a separate group for future allocation:

$$\text{Passive channel group} = \begin{Bmatrix} \{G \leftarrow \{Ci - C\}\} & Ci \in C \\ 0 & \text{otherwise} \end{Bmatrix}$$

Lemma 5: The group allocation to the user is based on minimum power level and all available channels:

$$\text{Group allocation} = \begin{Bmatrix} \{G \leftarrow Ci\} & Ci \in C \text{ and } PT \le PT\min \\ G \ne C & \text{otherwise} \end{Bmatrix}$$

Lemma 6: Channel selection is based on the active channel in the group with minimum power level:

$$\text{Channel selection} = \begin{Bmatrix} Ci & C \in G \text{ and } PT \le PT\min \\ 0 & \text{otherwise} \end{Bmatrix}$$

Lemma 7: Assignment of the channel to the user with active channel and minimum power level:

$$\text{Channel assignment} = \begin{Bmatrix} \{Ui \leftarrow Ci\} & Ui \in U, Ci \in C \text{ and } PT \leq PTmin \\ 0 & \text{otherwise} \end{Bmatrix}$$

Lemma 8: If the power level goes higher than the PT level, select some other group used to allocate the user:

$$\text{Channel assignment} = \begin{Bmatrix} \text{Select other group} & \text{if}(PT(Ci)) > \text{PT level and } i > 0 \\ \text{No selection} & \text{otherwise} \end{Bmatrix}$$

Algorithm of the proposed system:

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Let C is a channel list, i.e., C1, C2…,Cn;
Let PTlevel is a level of transmission power;
Let PTmin and PTmax are minimum and maximum level of the transmission power respectively;
Let G is the group, i.e., {G1,G2,…Gn};
Estimate the channel for user allocation;
Estimate the group for the available channels;
Label 1: Select the channels from the channel list;
        Formation of the group list;
        Select the group from the group;
If (Group_Size < maximum_number_group) then
        Goto label 1;
Else
        Arrange the entire channel in the list in ascending order;
Label 2: Select the channel for the respective group;
If (Number_of_user < Number_of_group) then
     If(Ci < channel_in_the_group)then
     Allocate the channel to the users;
     Else
  Select the channel from the existing channel in the group or channel from neighboring cells;
      Allocate the channel to the users;
      End
Else
Select the channel from other group;
Allocate the channel to the users;
Goto label2;
End
```

PERFORMANCE ANALYSIS

The traffic rate from the mobile station to the base station is shown in the Fig. 3. There are different CDMA data bits which provide the traffic with the range between 4 and -4. The total numbers of bits are represented as 31 columns www.clear.rice.edu/elec301/Projects01/cdma_dominate/code.htmhttp://en.wikipedia.org/wiki/Wireless accessed on [07.11.12]. The data bits are much closed between the range of +2 and -2.

The number of code or chip are shown in the Fig. 4. The chip are multiplied with the data samples by transmitting signals from mobile station to the base station. The range of the chip always falls between +1 and -1. There are 16 samples which is used to transmit the signal.

The encoded data sequences are shown in the Fig. 5. The multiplication of the earlier mentioned data sequence and chip which produces the encoded data

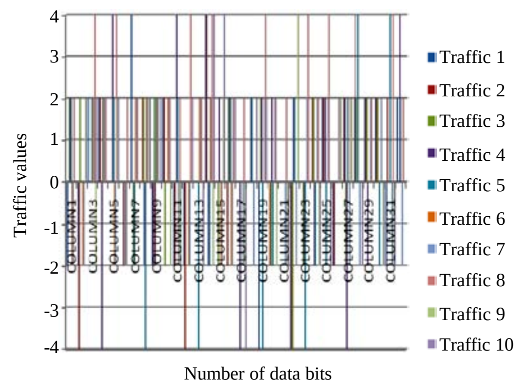

Fig. 3: Traffic values vs. data bits

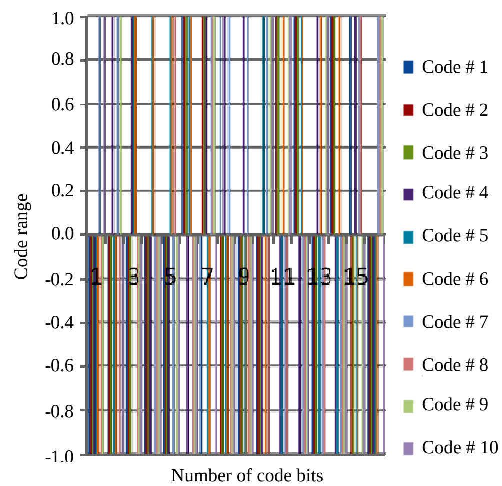

Fig. 4: Code range vs. code bits

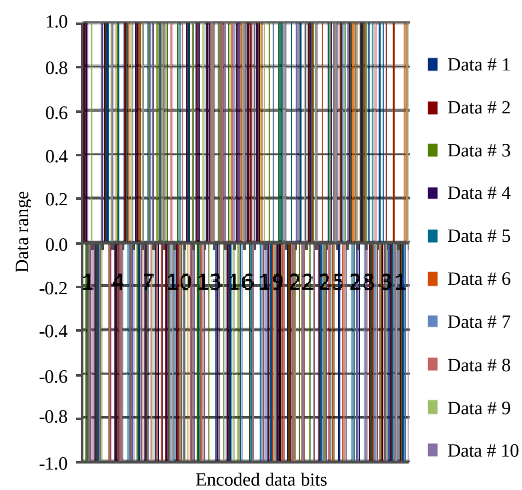

Fig. 5: Data ranges vs. encoded data bits

sequences in order to transmit the power from mobile station to the base station. There are 10 data sequeces used for analyzing the requsting transmission power.

RELAIBILTY ANALYSIS

The reliability measures are based on various factors for identifying the proper transmission power to the base station as a request. The following analysis of the data bits and code bits are in order to identifying the requested transmission power and also select the suitable channel in the group of channels.

Reliability of code bits: Figure 6 shows that the reliability of the code bits are analysed based on the success and unsucess factor. The success factor is calculated by subtracting the total number of code bits with total number of –ve ranges. The unsuccess factor is identified by subtracting the +ve ranges bits from the total number of code bits:

$$\text{Success factor} = \frac{\begin{pmatrix}\text{Total number of code bits -}\\ \text{Number-ve range bits}\end{pmatrix}}{100}$$

$$\text{Unsuccess factor} = \frac{\begin{pmatrix}\text{Total number of code bits -}\\ \text{Number+ve range bits}\end{pmatrix}}{100}$$

Reliability of data sequences: Figure 7 shows that the reliability of the data sequences are analysed based on the success and unsucess factor. The succuess factor is calculated by subtracting the total number of data sequences with total number of –ve ranges. The factor is identified by subtracting the +ve ranges bits from the total number of data sequences:

$$\text{Success factor} = \frac{\begin{pmatrix}\text{Total number of data bits -}\\ \text{Number-ve range bits}\end{pmatrix}}{100}$$

$$\text{Unsuccess factor} = \frac{\begin{pmatrix}\text{Total number of data bits -}\\ \text{Number+ve range bits}\end{pmatrix}}{100}$$

Reliability of transmiting data sequences: Figure 8 shows that the reliability of the transmitting data sequences are: also analyzed based on the success and unsucess factor. The succuess factor is calculated by multiplying the succuess factor of data sequences with succuess factor of code bits. The unsuccuess factor is calculated by multiplying the unsuccuess factor of data sequences with unsuccuess factor of code bits:

$$\text{Success factor} = \begin{pmatrix}\text{Success factor in code bits} \times\\ \text{Success factor in code bits}\end{pmatrix}$$

$$\text{Unsuccess factor} = \begin{pmatrix}\text{Success factor in data bits} \times\\ \text{Success factor in data bits}\end{pmatrix}$$

Analysis of the sub-carrier group allocation: The sub carrier are maintained in the various groups

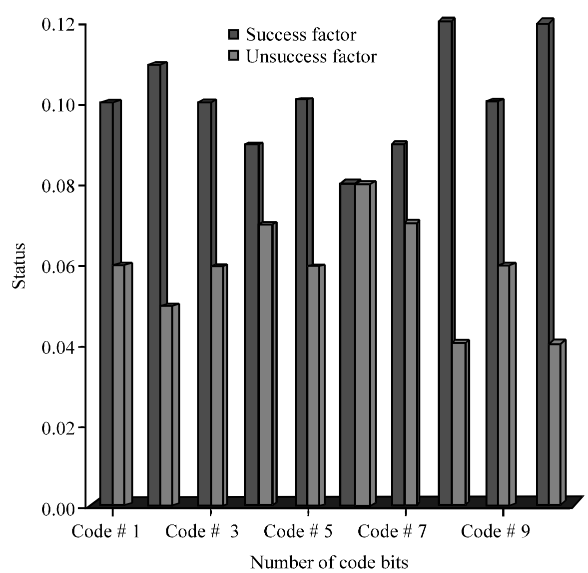

Fig. 6: Reliability of code bits

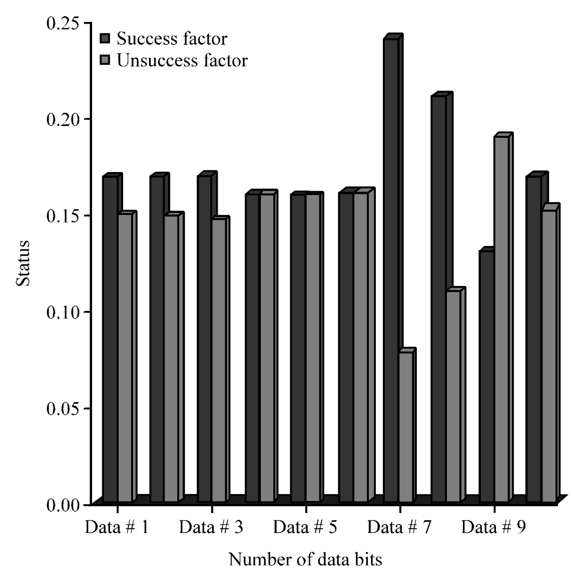

Fig. 7: Reliability of data sequences

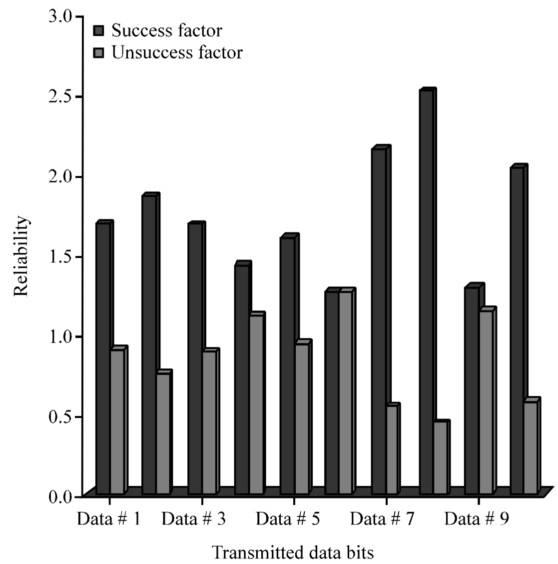

Fig. 8: Reliability of transmiting data sequences

G = {G1, G2,..., Gn}, sub-carrier S = {S1, S2, -Sn} and trasmission power level in the groups are Tp ={Tp_1, Tp_2,..., Tp_n}. The transmission power in the group Tp is compared with the requesting transmission power. It finds the best group among the group G and then selects the suitable Tp for efficient transmision between the base station and mobile station. The transmission power are arranged in the group in an increasing order. The minimum Tp is selected which is used to send the data sequence to the mobile station. Suppose the Tp is not available in the particular group then it selects from other group and so on. The groups are reorganized as soon as the lower number of Tp in the group so the requested Tp is always available in any group which leads the availabilty of the channels. The proposed research focuses on group reorganization in order to achieve channel availability for better eficiency.

CONCLUSION

The wireless communication has been applied in various places like information exchange. The data sequence is moved from mobile station to the base station vice versa. There are various methods of modulation schemes are used to send and receive the data sequence. FDMA, TDMA and SDMA are the techniques which are used to assign the different channel to the different users. The OFDMA (Orthogonal Frequency Division Multiple-Access) techniques are used to support multiple users who can communicate with the single base station to improve the throughput. The channel with minimum transmission power has been assigned to the user. There are various techniques that support the channel to the multiple users. These channels are formed as a group in order to achieve the high throughput. The proposed technique is focused on channel group reorganization for maintaining the channel always available to the users. Suppose the requested channel is not available which leads a performance problem then the services are reorganized with the required channel using the selection technique. Suppose the channel unavailability occur it will select a suitable channel from various group. The plenty of analysis and reliability measures are taken place for maintaining the effective communication. The channel alignment and assignment were implemented at the base station for making effective communication. In future the throughput will be improved by using an efficient technique.

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