

A method of reducing the interference of signals in MIMO technology

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Abstract. To increase the operating power of a radio Link, multiple antenna are placed in both transceiver parts. This system is called multiple Input multiple output or MIMO. The point of signals interference is one of the important challenges in use of MIMO technology which in this article, was addressing to solve the problem of interference of these signals in MIMO tech through Beam forming clear and Decoding place in transceiver (sender & receiver) and eventually compare the results of both methods. The results of research showed that the mentioned decoding method leads to very much reduction in signal interference in MIMO tech. In addition to applying of this method with incorporation of more band width, obviate most of these interference problems somewhat. In this article, the method of beam forming clear Leads to decrease of signals interference in amount of 48%. The method of decoding place in transceiver leads to Decrease of signals interference in amount of 63% and the combined method of increase and decoding place in transceiver leads to decrease of signals interference in amount of 67%.

Key words. MIMO tech, interference, receiver, decoding place method.

1. Introduction

The phenomenon of signals interference is one of the major problems in wireless communications network. So it create several technology for decrease the effects of signals interference in these networks. The phenomenon of signals interference has negative effect on MIMO tech function and in some cases Lead to cancelling the sending information from transmitter to receiver. So several methods have designed and introduced for decrease interference of these signals including: Beam forming and decoding place in transceiver. Actually the beam forming is a radio signal transferring method. The function of beam forming in decreasing the signals

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interference in MIMO tech is like this, actually you control the output specifications of every antenna in during data transmission. The decoding place method is like this, areas that in them, the signals interference in MIMO tech, have most density, are identified [1]. To ensure the prevention from interference signals in MIMO tech, between the sender & receiver, Electronic equipment should be on both end of a physical medium, & this equipment need to a circuit to measure the time of sending and receiving the signals to prevent of interference of them, through time tuning [2]. Some of the flows of Beam forming clear method are SD waves deviation to up and down, late arrival of waves to receiver and being complicated process for simple receiver and some of flaws of linear coding methods are need to be carefully and sync of transmitter with receiver and Dispersion of waves in different directions that some of them are unwanted [3].

To describe the method that is used for prevention of signals interference, a series of signals are coded that is called linear coding [4]. We use the term of compression to Hint the method that decreases number of necessary signals in every second for prevention of signals interference in MIMO tech in appropriate level. In this case, two kinds of compression is introduced: With deleting signals some of signals are last during compression a without deleting signals—all signals remain in compressed version [5–7]. Compression without signals deletion keeps primitive data without any change [8].

In this article, a method based on combined of two above methods is presented, to decrease signals interference in MIMO tech. in the first part (introduction) an overview about signals interference in MIMO tech and selected methods separately, research theoretical, applying of Linear coding, Manchester coding, Differential Manchester coding, compression and coding methods for decrease signals interference in MIMO tech has described, while the kinds of beam forming methods & phenomenon of “variety” is describe too. The second’s part (suggested method) is about the description and explanation of the suggested method in this article. At third & fourth part, respectively, the suggested and combined methods are implemented, and at the last part, the results are raised.

2. Suggested method

In this article the decoding place method in transmitter and receiver compared with clear beam forming, to decrease the signals interference in MIMO tech is evaluated and then, it has combined with network bandwidth method. In use of beam forming method, at first several transmitter and receiver are considered in the same technology and the signals are send from transmitter to receivers through MIMO tech. the number of areas that signal interference happen in them and percent of their interference is reviewed. Then the same test with same signals through beam forming is repeated and again the number of areas that signals interference happen in them and percent of these interference is computed. Every interference area was assigned a code based of interference area space with transmitter and receiver. With encoding the mentioned areas, the amount of interference of these signals is decreased. The results of both methods are compared and in the following to recov-

ery the given results, the method that has most decrease in signals interference, is combined with network bandwidth method.

The objective function is

$$F = Ax + Bt + Cy, \quad (1)$$

where x is the percent of signals interference, t is the time of interference (seconds) and y is the place of interference (space from the transmitter to meter). F is also the measure of created interference in signals in MIMO tech. A , B and C are constants that are obtained through try and error tests and, therefore, in some of references, including [7], these amounts are equal more amounts of x , t and y . The effective parameter of designing are listed in Table 1.

Table 1. Effective parameters on designing

Parameter	Row
Time (t)	1
Percent of interference (x)	2
Place of interference (y)	3
Number of transmitter	4
Number of receiver	5
Kind of modulation	6

3. Results

3.1. Implementation of beam forming and place decoding method in transceiver to decrease the signals interference in MIMO tech

Implementation of beam forming method at first seven transmitters and receivers (overall 14 transceivers) is applied in mobile tech and signals through MIMO tech from transmitter to receiver, with discrete shifts modulation in frequency (FKS) are sended. To each area of signal interference is assigned a name. The number of areas and the time of the signal interference that happen there, is presented in Table 2.

According to the Table 2 the interference has created in 5 areas that most of these interferences in maximum a day after sending signal from transmitter to receiver, for the first time has created and the peak of them is about 8 to 9 am, 5 to 7 pm and 10 to 12 in the night. The intensity of each one of these interference has computed and presented in Table 3.

According to the Table 3, the areas that the amount of interference in them is more than 50%, are critical areas and they negatively effects on used MIMO tech function and surely it should take actions to remove or decrease these interferences. To decrease these interferences, the clear beam forming method is applied. In this case, the communication between the transmitter and receiver get stronger and the interferences are decreased. In this case also, the number of areas and the time that

signals interference happen in them are defined and the result of them has presented in Table 4.

Table 2. Number of areas and the time of signals interference in MIMO tech before applying of clear beam

The time of interference in a day	The time of interference	Name of signal interference area
Between 8 to 9 am	4 hours after sending signal from transmitter	A1
Between 5 to 7 pm	6 hours after sending signal from transmitter	A2
Between 5 to 7 pm	A day after sending signal from transmitter	A3
Between 10 to 12pm	A day after sending signal from transmitter	A4
Between 10 to 12pm	A day after sending signal from transmitter	A

Table 3. Name and percent of each one of interferences in MIMO tech before of applying the clear forming

The percent of created interference	The name of signal interference
32 %	A1
57 %	A2
61 %	A3
60 %	A4
85 %	A5

Table 4. The number of areas and the time of signal interference in MIMO tech after applying the clear beam

The time of interference in day	Time of interference	The name of signal interference
Between 5 to 7 pm	6 hours after sending the signal from transmitter	A2
Between 5 to 7 pm	One day after sending the signal from transmitter	A3
Between 10 to 12 night	One day after sending the signal from transmitter	A4
Between 10 to 12 night	One day after sending the signal from transmitter	A5

According to the Table 4, with applying the clear beam forming method, the number of interference areas decreased from five areas to four areas. These interference in maximum a day after sending signals from transmitter to receiver, for the first time has been created and the peak of them is at 5 to 7 pm and 10 to 12 night and the signals interference removed at 8 to 9 am. The percent (intensity) of each one of these interferences, computed again and it has presented in Table 5.

Table 6. Name and percent of each one of created interferences in MIMO tech after applying the clear beam forming

The percent of created interference	The name of signal interference
39 %	A2
45 %	A3
40 %	A4
49 %	A5

According to Table 5, with applying the clear beam forming method, the intensity of all the signals interference in MIMO tech, decreased under 50 % and all the interference areas became UN critical. The used MIMO tech function recovered and with applying the clear beam forming, overall 65 % of signals interference decreased. Implementing the place decoding method is also in this case, transceiver Like the clear beam forming method, apply seven transmitter and receiver (overall 14 transceiver) in mobile tech, and signal through MIMO tech from transmitter to receivers, with discrete shifts modulation in frequency (FKS), are send. Each area of signals interference are assigned a name. the number of areas and the time that signals interference happens in them, has presented in table (2) that according to this table, the signals interference has created in 5 areas which these interferences in maximum a day after sending the signals from transmitter to receiver, for the first time has created and peak of them is at 8 to 9 am, 5 to 7 pm and 10 to 12 night the percent (intensity) of each one of these interferences computed and it presented in table (3). In this case also the number of areas and the time that signals interference happen in them, are defined and the result of them has presented in following Table 6.

Table 6. The number of areas and the time of signals interference in MIMO tech after applying place decoding in transceiver

The time of interference in day	Time of interference	The name of signal interference
Between 5 to 7 pm	a day after sending the signal from transmitter	A3: 38 %
Between 10 to 12 night	a day after sending the signal from transmitter	A4: 25 %
Between 10 to 12 night	a day after sending the signal from transmitter	A5: 22 %

According to Table 6, with applying the place decoding method in transceiver, the number of interference areas decrease from 5 areas to 3 areas. These interferences in maximum a day after sending the signals from transmitter to receiver , for the first time has created and the peak of them is at 5 to 7 pm and 10 to 12 night and the signal interference at 8 to 9 am removed. The percent (intensity) of each one of these interferences, computed again and in has presented.

3.2. Implementation of suggested method of the two selected methods to decrease the signals interference in MIMO tech

The place decoding method in transceiver has more positive after on these interferences, in comparison to clear beam forming method .therefore, we combine this method with bandwidth and the result has presented in Fig. 1.

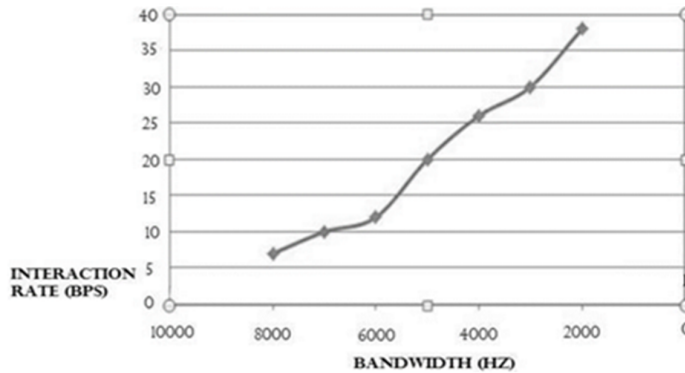


Fig. 1. Decreasing the signal interference in MIMO tech with combining the more band width method and place decoding in transceiver

According to Fig. 1, in combination the increasing band width method and place encoding method in transceiver, with increasing the band width, the signals interference in MIMO tech decreases and it can be said that this problem almost disappears because of that by increasing band width, the signals have more space for sending and receiving and so they have less conflict with each other. In the following the function of all three methods, the clear beam forming, place encoding in transceiver and the combination of more band width and place encoding in transceiver to decrease the signals interference in MIMO tech compares with each other. According to Fig. 2 all three methods of clear beam forming , place encoding in transceiver and the combination of more bandwidth and place encoding in transceiver, to decrease the signals interference in MIMO tech are effective methods. But among the three studied methods in this article, the clear beam forming method lead to decreasing the signals interference from 85 % to 37 %, the place encoding method in transceiver lead to decreasing the signals interference from 85 % to 18 %. So the mentioned combined method is the best method for decreasing the signals interference in MIMO tech.

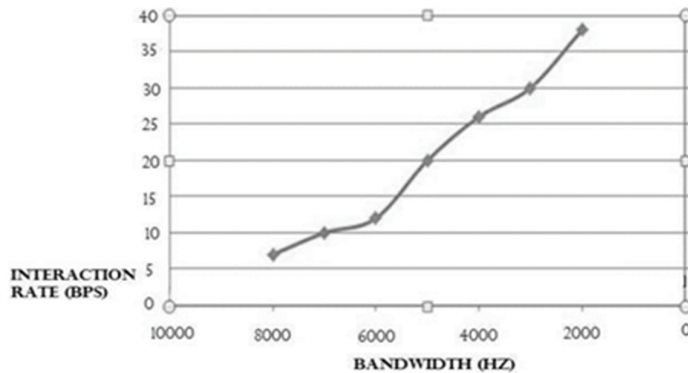


Fig. 2. The comparison of function of all three methods of beam forming, in MIMO tech

4. Conclusion

MIMO is a wave (Antenna) propagation tech for wireless telecommunication systems. MIMO tech by dramatic increase of data through put and distance of beneficial effect, it also needless to additional band width OD transmitter power, has a special place in wireless telecommunications. One of the basic problems in decreasing of MIMO tech function, is the signals interference that in this article, three scenario of clear beam forming, place encoding in transceiver and the combined method of more band width and place decoding in transceiver for decreasing the signals interference are suggested. All three methods of clear beam forming, place encoding in transceiver and the combines method of more band width and place encoding in transceiver for decreasing the signals interference in MIMO tech are the effective methods. But among three studied methods in this article, the clear beam forming method lead to decreasing the signals interference in amount of 48 %, the place encoding method in transceiver leas to decreasing the signals interference in amount of 63 % and the combined method of more bandwidth and place encoding in transceiver lead to decreasing the signals interference in amount of 67 %. So the mentioned combined method is the best method for decreasing the signals interference in MIMO tech. We can use clear beam forming method for decreasing the interference in available MIMO tech in small networks, that have less signal interference, combined method, can be used to solve the seven signal interference in MIMO tech. It is worth mentioning that increasing bandwidth in combined method has also flaws that as a challenge it can be checked in further studies.

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