Bit error probability curve for BPSK in ISI channel with MMSE equalizer

منحني احتمالية الخطأ BPSK لحساب التداخل بأستخدام معادل MMSE

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Abstract:

Theory coding is methods to study for effective and exact transfer the information from point to another point. This theory had been advanced for example many applications as to decreasing the noise from received signal, when the transmission of most information in telephone line, information transfer from terminal (computer) to another terminal or from any memory to the main processor and data transmission from transmitter such as satellite communication which led images of Saturn earth. A channel is mien physical medium which the data or (information) transmission. Disturbances undesirable called noise. This noise caused the differ the information signal from the transmitted data. Noise may be caused folds in a tap magnetic, telephone competing messages, sunspots, meteor showers, lightning, radio random disturbance or other many things.

In my paper I used the MATLAB program to simulations over AWGN channel by using BPSK modulation scheme I notice when used more tap point I get the decreases for bit error rate and this method one of theory coding deals with problem of correcting and detecting error transmission caused by noise in channel. In practice, we has over this noise that mast choice of good a channel to use the transmission data (information) and to used variable noise filters to combatable certain type of interference may be cannot be controlled.

Key words: coding theory, AWGN, BER, BPSK and ISI.

ملخص البحث :

نظرية الترميز هي احدى طرق البحث عن فعالية ونقل المعلومات والبيانات من نقطة إلى نقطة أخرى وبدقة عالية جدا. وقد طرحت هذه النظرية على سبيل المثال في العديد من التطبيقات لخفض الضجيج من الأشارة المستلمة او المرسلة، كما في نقل البيانات و المعلومات في خط الهاتف، وكذلك نقل المعلومات من محطة (الكمبيوتر) إلى محطة أخرى أو من أي الذاكرة إلى المعالج ونقل البيانات الأساسية في الارسال مثل الاتصالات عبر الأقمار الصناعية والصور الفضائية. وعند عملية النقل تتأثر هذه الاشارات بأشارات اخرى غير مرغوب بها تسمى الضوضاء والتي تسبب ضعف او تشويه للأشارة المستلمة او المرسلة. قد يكون سبب الضوضاء اشارات من اجهزة مغناطيسية او رسائل هاتفية اخرى أو أشياء أخرى عديدة.

في هذا البحث أنا استخدم برنامج MATLAB لمحاكاة على قناة AWGN باستخدام BPSK واستخدام أكثر من نقطة لغرض الحصول على انخفاض لمعدل الخطأ وهذا أسلوب واحد من نظرية الترميز يتناول مشكلة تصحيح وكشف الخطأ في البيانات الناتج عن الضوضاء في القناة وبطريقة عملية، ويوجد لدينا أكثر من نوع للضوضاء.

Introduction

The error control for coding method notice, and correct possibly, errors that be happen when messages are to transmitted in communication system (digital communication system).[1] To improve this, the encoder transmits the symbols information and extra redundancy symbols. The decoder explains this information when it receives, in this technique using the redundant symbols to correct and detected the errors occurred during the transmission.[2] This technique use when the transmission channel is very noisy or the information (data) is very sensitive to noise. The block coding is the technique of error control coding is the map the constant of number for the message symbol and use the fixed number of bit coding (redundant symbols) and each the block coding

technique treat the memory less and the correct the error in the information. Use this technique in the communication system and simulated by using the MATLAB function and system objects.[3]

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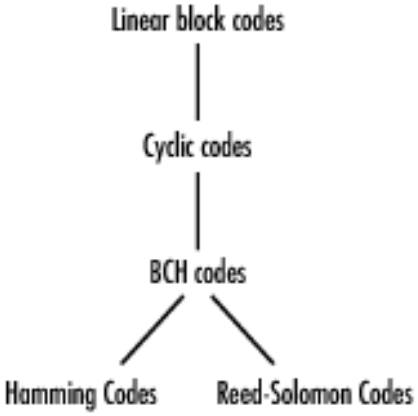


Figure (1). The class of block coding methods is contain categories.[4]

The linear block coding in communication system it also cyclic process, red Solomon and Hamming coding (this kind of coding is special categories of linear block coding in communication system and when use this technique in the producing can decoder and encoder a message use one of the mentionable technique and when we use the red Solomon and BCH encoder show the numbers of error in the information data and this technique decided whether to using bit as your data or symbols.[5]

Additive white Gaussian noise (AWGN) channel:

In order to recognized Additive white Gaussian noise (AWGN) channel represented white noise to the information for signal has been passed through it. This a mount of white noise in this channel can be describe by following quantities:

The value of signal to noise ratio for each sample, the value of signal to noise ratio is represented the actual parameter of Additive white Gaussian noise channel. [6]

And we can represented this relation by this equation following:

$$\frac{E_s}{N_o}(dB) = \frac{E_b}{N_o}(dB) + 10log_{10}(n) \quad \ldots\ldots^{[7]}$$

That is parameters may be influence by the kind of modulation alphabet and error control code of the code rate. [7] When we analysis of the performance of this codes is represented by terms of BER and we used he modulation BPSK in this simulation, and this simulation done on MATLAB. And the following plots BER for uncoded and coded data of bits. And by used different code value rate.

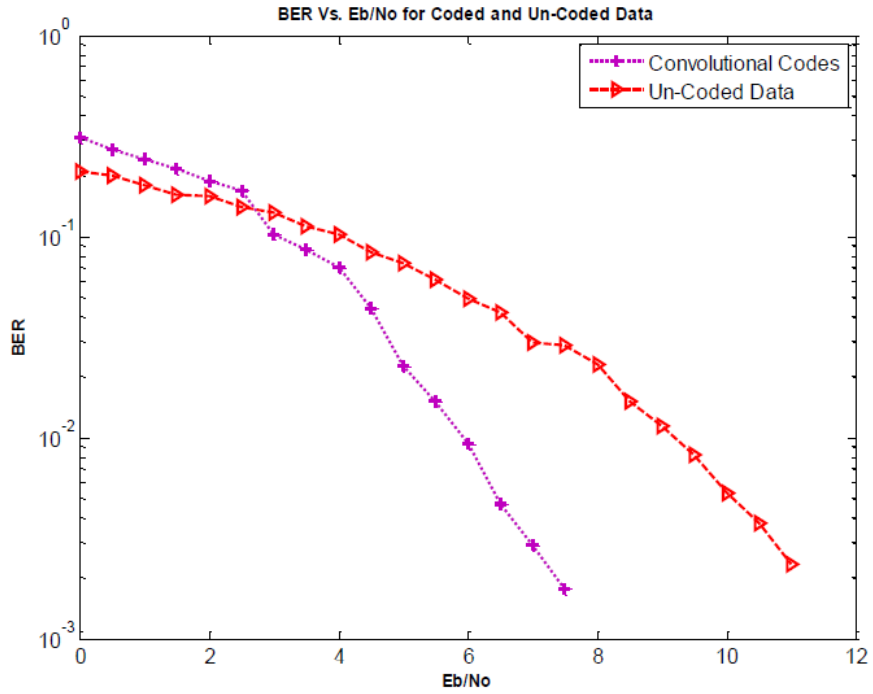


Figure (2): BER (bit error rate) versus E_b/N_o for Un-coded and coded data

In the figure 2 the bit error rate (BER) plot un-coded data and coded data are shown. This is that quite clear that when by increasing the code data rate, bit error rate performance degree. When we get the good rate code we get the good performance as to the compression with the code rate this is due to increasing complexity of the communication system but the expense of the performance degradation. The bit error rate in the figure 2 we use the channel without use the manner of the convolution code and the data or any information is passed through the channel before the code or added any bit for the message and when at the receiver is added to decode the data for the convolutional decoder. [8]

In the figure 3 when we use the different value of the code rate in this fig when we increasing the code rate the bit error rate performance is degrades. [9]

In the figure 4 the bet error rate is shown for a dual data (information) when we use the convolutional code the best of performance than that of the un-coded information.

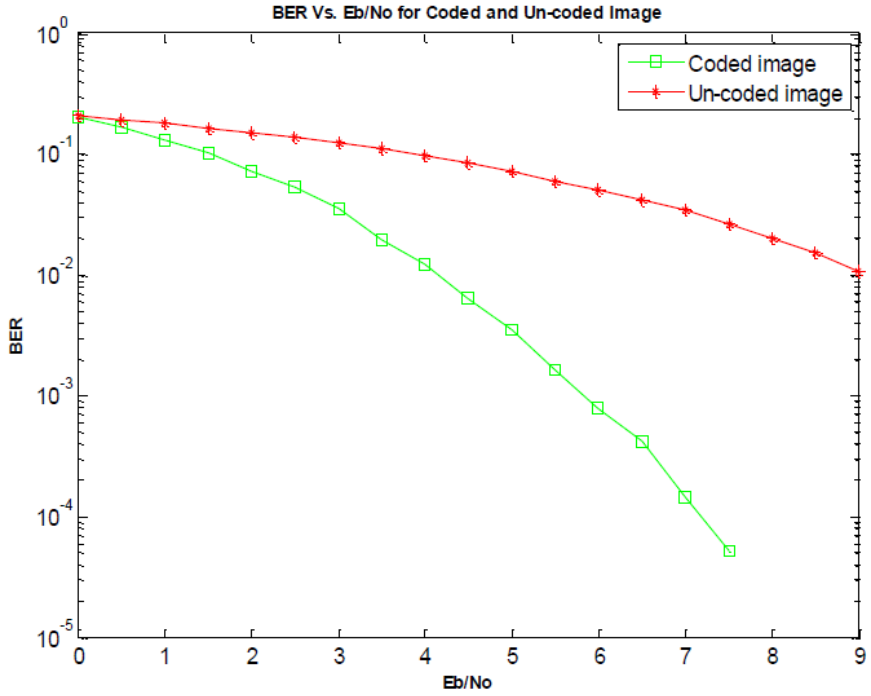


Figure (3): BER versus E_b/N_o for coded and Un-coded image

The first value ½ and 2/3 the performance degrades when the code rate is increasing, the 1/2 code rate we get the best performance when we compare with 2/3 code rate this is due to increase the complexity to the communication system.

Methodology :

In this paper the channel coding is one type of described Hamming namely codes. This performance is analysis with the bit error rate by the different parameter rate code, The un-coded and code information, and using the Hamming codes is analyses with the binary random is transferred by the channel, All this data is simulation by use the MATLAB program over the additive white Guassian noise channel use BPSK modulation mode.

Code rate length : $n = 2^m - 1$

Number of information bits : $k = 2^m - 1 - m$

Number of parity bits : $n\text{-}k = m$

correction Error capability : $t = 1$

Simulations and Results

When we calculation the performance of the Hamming coded with the bet error rate by using the MATLAB program simulation function. This simulation are behaviorism the additive white Guassian noise channel (AWGN) channel when we used the binary phase shift keying (BPSK) and in figure 4 comparesion between the prepared un-coded and coded information over the additive white Guassian noise channel (AWGN).

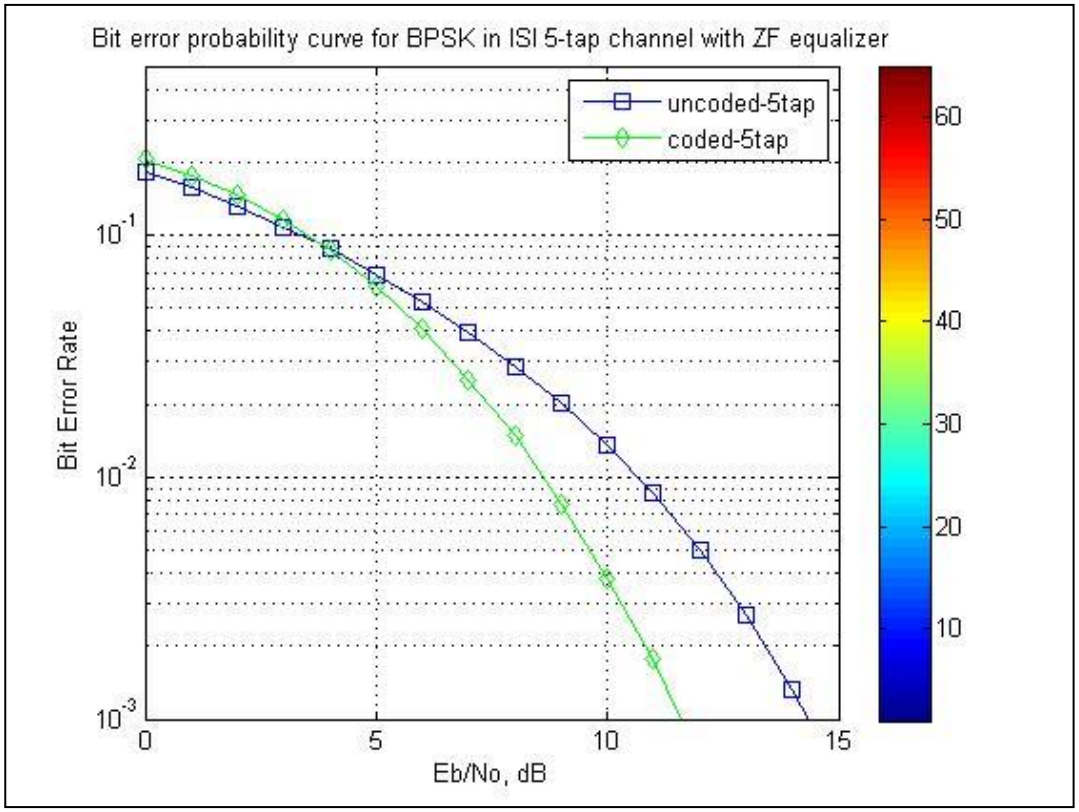


Figure (4) Bit error probability curve for BPSK in ISI channel with ZF equalizer using Systematic Hamming code (15,11)

$(E_b/N_o)_{uncoded}$-$(E_b/N_o)_{coded}$=14.3446-11.5758

Providing gain =**2.7688 dB**

In the fig. (5) We have the two type of different coding schemes. That it is known Hamming code equipped and this coding it has good performance as when we compare with the other types of coding. When we see the diagram the good gain and performance is 1dB for the bit error ratio (BER)

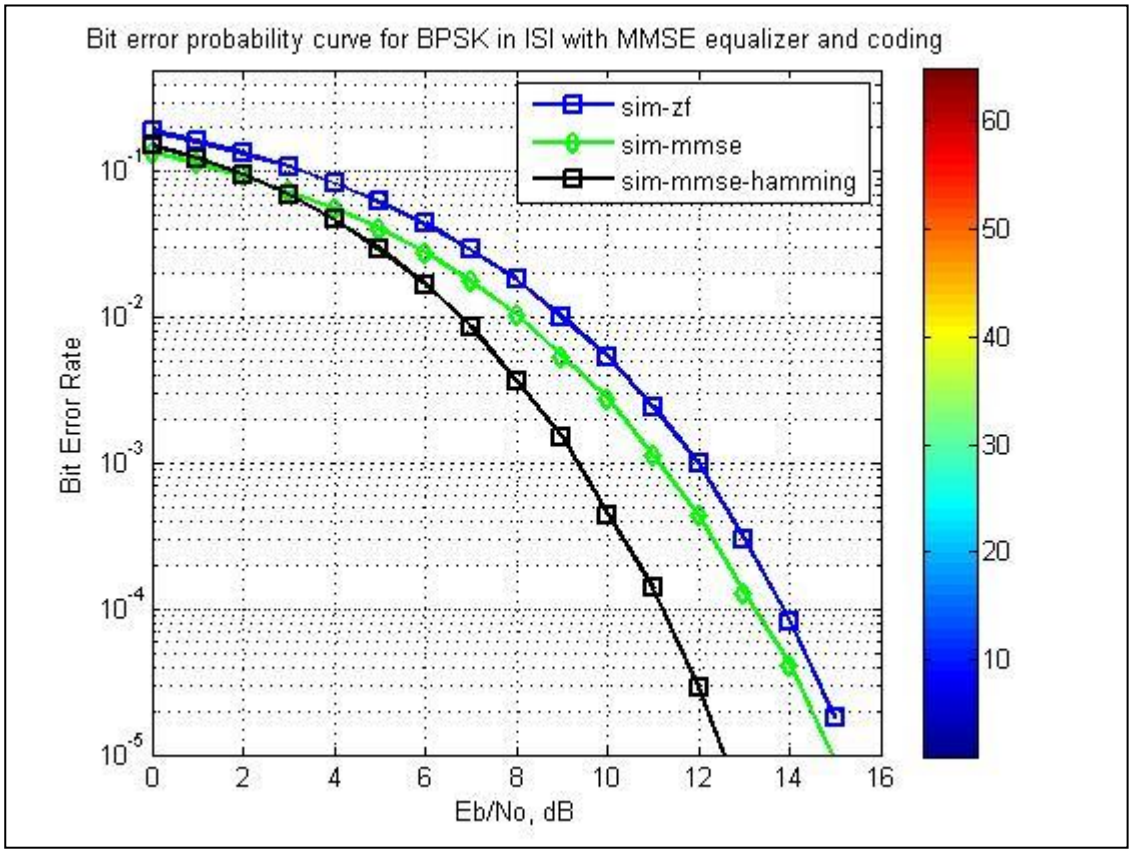


Figure (5): BER curve for BPSK in ISI channel with MMSE equalizer using Systematic Hamming code (15,11)

$(E_b/N_o)_{uncoded}$-$(E_b/N_o)_{coded}$=14.5322-12.5679

Providing gain =**1.9643 dB**

We notice that the providing gain when using the coding in the zero forcing equalization is greater than in the mmse equalization

Providing gain in ZF > Providing gain in MMSE

Because the zero factor equalized for the zero base design modified the noise in channel for MMSE equalizer is provide good noise for the bit error ratio decrease with the equalizer zero forcing for the channel noise free. MMSE improving BER, and the AWGN channel is decreases when we use the MMSE equalization technique.[9]

Systematic Hamming code (31,26)

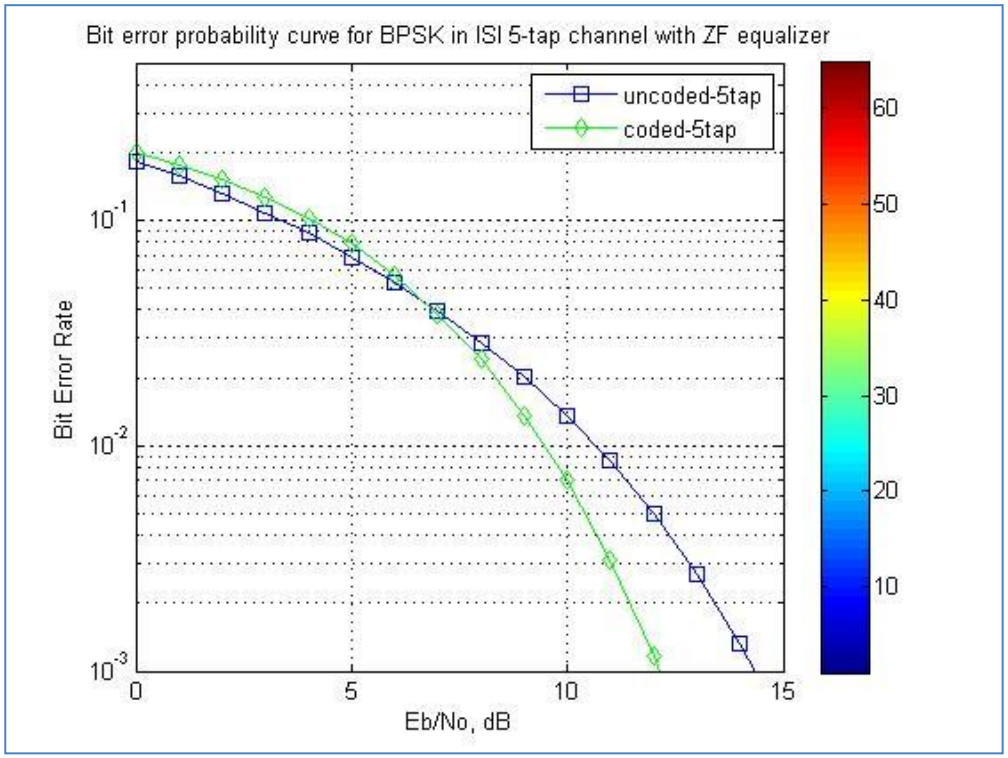
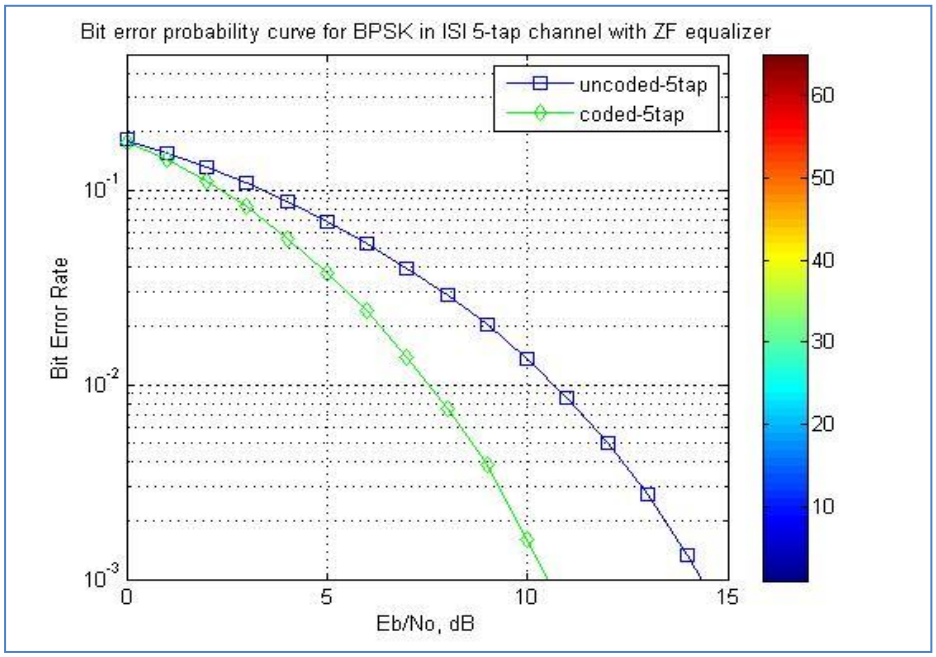


Figure (6): Bit error probability curve for BPSK in ISI channel with ZF equalizer using Systematic Hamming code (31,26)

$(E_b/N_o)_{uncoded}$-$(E_b/N_o)_{coded}$=14.5322-12.1693

Providing gain =**2.3629 dB**

Systematic Hamming code (7,4)



$(E_b/N_o)_{uncoded}$-$(E_b/N_o)_{coded}$=14.5322-10.5

Providing gain =**4.0322 dB**

From the figure 1 and 2 we notice when increase the n ,k get degrease in the coding gain in case one for (15,11) we obtain the coding gain from the relationship $(E_b/N_o)_{uncoded}$-$(E_b/N_o)_{coded}$ get **2.7688 dB**. When the addition for (15,11) implies code when bandwidth increased and when we transmit power with out change the energy per bit has will decrease by the factor of (n,k) the transmit rate increase by the factor of the (n,k) this factors due to the power transmit unchanged. And when we increased the Energy implies this it effective for the signal to noise ratio SNR due to decreased but when the effect linear W this is due to outside overcomes bracket. And the final result is increase with the bandwidth BW. And the outcome effectively a channel inserting. To achieve improvement performance bit error ratio (BER) the bandwidth is higher and when we expansion the bandwidth the performance id improved by measured the gain coding due to difference between Eb/N0 without and with coding probability of error for given. This that one implies achieve potentially BER given at the Eb/N0 lower employing for transmission higher bandwidth BW.

CONCLUSION

In this paper we cavers the performance of the Hammaing code when we used the data randomly binary. That revealed Hamming code afford much good performance error when we compare without coding for data used. the Bit error probability for BPSK in ISI channel with ZF equalizer and MMSE equalizer. It is revealed varying how that coding will rate bother the capability of system error correct or similarity. So, we deduce that with Hamming codes BER can achieved. And when increase the (n,k) the coding gain is decrease.

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