VOL. 12, NO. 8, APRIL 2017 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences
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www.arpnjournals.com

ANALYSIS OF ENCODING TECHNIQUES IN WIRELESS PSK MODULATION

M. Meena and V. Rajendran
Department of Electronics and Communication Engineering, VELS University, Chennai, India
E-Mail: meena.se@velsuniv.ac.in

ABSTRACT

Wireless communication is nothing but a mobile communication which plays vital role in the world. Wireless communication has much greater impact on the communication networks in present as well as future. But, still the total availability of bandwidth is not efficiently used. It is difficult to find the availability of unused spectrum. Using an efficient method the unused spectrum can be found and given to multiple users. The noise in the channel is dynamic and will not be known to either be a transmitter or receiver. The Encoder block is mostly added in a communication block in order to combat the above effect. For efficient transmission, comparing and finding the best encoding technique is done using LABVIEW stimulator.

Keywords: convolution codes, hamming codes, AWGN, Rayleigh, lab view.

INTRODUCTION

The information that is transferred between the two or more points is called wireless communication. Radio is the common wireless technology. Radio waves distances for television can be very minimal, like few meters or thousands of kilometers for deep space radio communications. The communication has various types of fixed, including two way radio mobile applications, cellular telephones, wireless networking and personal digital assistants (PDAs). GPS units, keyboards and wireless computer mice, headsets, etc. are examples of radio wireless.

The mobile phone technology is widely used in the wireless communication, with more than 4.6 billion mobile cellular are used worldwide. Wireless phones will use radio waves from transmission towers to make phone calls by the user from one place to another. It can be used within the range of the mobile telephone site used to transmit and receive the radio signals from these Instruments. Phase shift keying is a digital modulation technique that sends data by changing the phase of a reference signal which is nothing but the carrier wave. We are using PSK modulation technique to find out the best encoding technique in wireless communication.

In PSK modulation, we are using a variant called QPSK, sometimes called 4-PSK. QPSK has 4 points on the constellation diagram, which is similarly dispersed around a circle. QPSK can encode two bits per symbol, with Gray coding to minimize the bit error rate (BER). QPSK is less demanding to see it has two independently modulated quadrature carriers. The even bits are utilized to modulate the in phase section of the carrier, and the odd bits are utilized to modulate the quadrature phase section of the carrier. BPSK strategy is utilized on both of the carrier signal and they can be demodulated independently.

Hence, the probability of BER of QPSK is the same as BPSK [1].

Different encoding techniques

Encoding is the process of converting original data into a transmittable format. This can be done using words, symbols and pictures. There are many encoding techniques. The commonly used techniques are Convolution coding linear block coding.

Convolutional coding

It is a type of error detecting code that generate parity symbols and used to transmit digital data over communication channel.

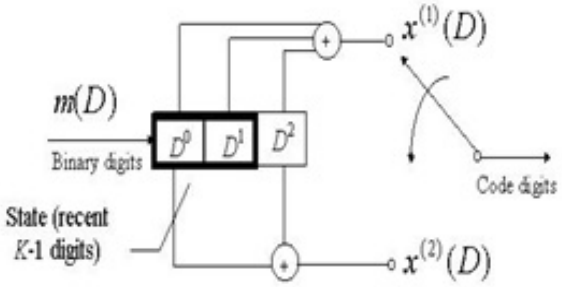

Figure-1. Block diagram of convolutional encoder.

The new values of x (1) and x (2) is generated depending upon Do, D1and D2 when the message bit is shifted to position "Do", D1 and D2 stores the previous two message bits. The current bit is present in Do.
In this way we can give it as

X (1) =Do+D1+D2 and

X (2) =D0+D2

- The output moves the first samples x (1) and x (2).
- Shift register then shift the contents of D1 and D2.
- Input bit is then taken and stored in D0.

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- X (1) and X (2) are generated again according to the new combination of Do, D1 and D2.
- The output then moves first samples x (1) and x (2).
- Then the output bit stream for successive input bits will be,

X = x (1) x (2) x (1) x (2) x (1) x (2) ……
and so on

For a single message bit, the encoded code word is two bits. Here in convolution codes, the information bits are followed by the parity bits. For this convolution encoder,

Number of message bits, k=1

Number of encoded output bits for one message bits, n=2. The code rate of encoder is,

r = k/n = ½

Here we observe that if a particular message bit enters a shift register, it will remain in the shift register for the three shifts [2].

Linear block codes

Parity bits (n, k) are added to the block of k message bits. Hence the total bits at the output of channel encoder are "n".

Hamming codes are used in linear block codes.

Hamming codes

Hamming codes (n, k) are linear block codes. The following conditions can be satisfied by this code,

Number of check bits q>=3
Block length n=2q-1
Message bits k=n-q
Minimum distance d min is 3.

Since the minimum distance dmin of Hamming code is 3, code can be used to sense the double errors or to correct the single errors.

This can also be obtained from the generalized. We know that the codes rate for hamming codes is given as,

r = k/n = (n-q) / n
r = 1- (q / n)

Effect of coding techniques in LabVIEW

LabVIEW stands for Laboratory Virtual Instrument Engineering Workbench. It is a system-designed platform and program development environment. LabVIEW compiler gives a code to the CPU platform. By changing the syntax and by compilation the graphical code is translated into machine code. The LabVIEW syntax cannot be changed during the editing process and it is compiled into an executable machine code in the execute process. In LabVIEW we have compared convolutional and hamming code and calculated the BER for both.

CHANNEL NOISE

Here we have used two different channels to compare the encoding techniques in LabVIEW. They are:

a) AWGN(adaptive white Gaussian noise)

b) Rayleigh

Additive white Gaussian noise (AWGN)

It is one of the basic noise model. In this additive model when it is added to any noise that can be essential to the information system. White refers to an idea, that it has unvarying power across the frequency band in the information system. It has an analogy to the color white were it has uniform emission at all frequencies. It has a normal distribution in time domain with an average time domain value of zero.

Rayleigh

It is a statistical model that can used by wireless devices to satisfy the effect of a propagation of a radio signal. Rayleigh model assumes that the magnitude of a signal passed through a transmission medium will vary randomly, according to a Rayleigh distribution. This means that the radial component of the sum of two uncorrelated Gaussian random variables [3].

Convolutional and hamming codes in LabVIEW

In LabVIEW we have made a coding for convolutional and hamming codes and obtained the BER graph for AWGN channel.

The table is given below with Eb/No and BER ratio:

Table-1. Comparison table of convolution and hamming codes.

Channel	EB/No	Convolutional Codes (BER)	Hamming Codes (BER)
AWGN	5	0.0031057	0.0113715
	6	0.000595134	0.00465063
	7		
		0.000145033	0.00141019
	8	0.000005001	0.000250034
	9	0.000005001	0.000100014

From the table above we can clearly say that a convolutional code has the lowest BER and it is the best coding technique.

AWGN and Rayleigh channel in LabVIEW

Here we have done a coding in LabVIEW to compare AWGN and Rayleigh channel to out the best channel.

As stated above, convolutional codes is found to be the best one with low BER so, we have use this to compare the channels to find out the best one.

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The comparison table is given below for both the channels:

Table-2. Comparison table of AWGN and Rayleigh channel.

Coding Techniques	EB/No	AWGN (BER)	Rayleigh (BER)
Convolutional Codes	5	0.00340577	0.00077515
	6	0.000645145	0.00065513
	7	0.000070015	0.00070514
	8	0.000010002	0.00076515

From the above table, it is clear that AWGN channel results in better BER when compared to Rayleigh channel in convolutional encoder.

RESULTS

This section analyses the BER performances. Firstly the performance of convolutional is measured for AWGN channel.

The BER performances graph for convolutional code is given below:

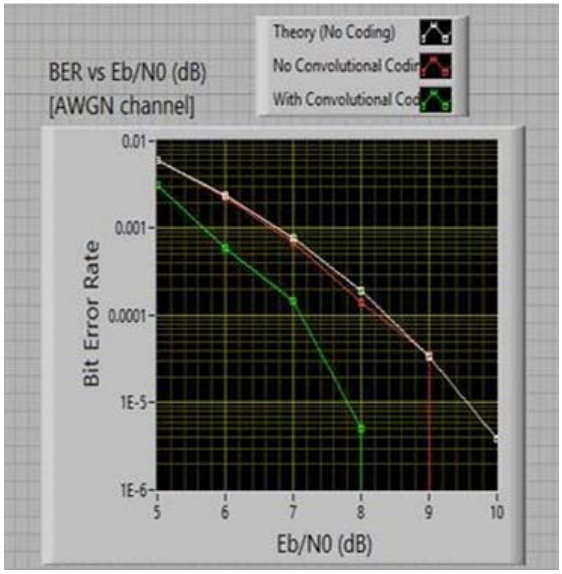

Figure-2. BER performance of convolutional code in AWGN channel.

As shown in the above figure, convolutional coding is found to have the low BER when compared with theory. So, convolutional coding technique is best when compared with theory.

Second, the Performances of hamming code is considered for AWGN channel.

The BER performance graph for hamming code is given below:

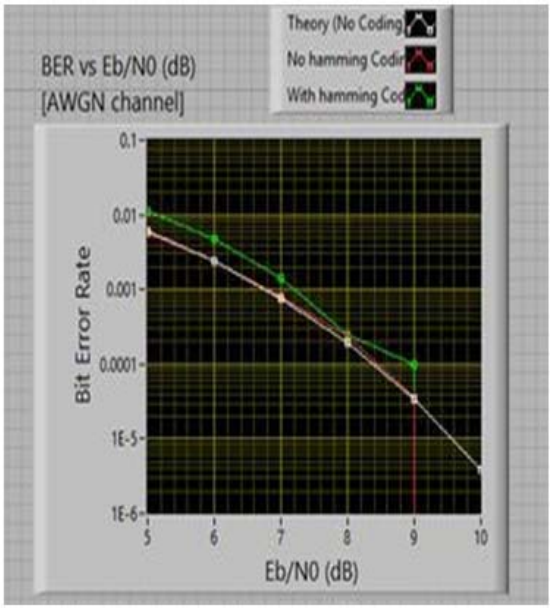

Figure-3. BER performances of hamming code in AWGN channel.

From the above figure it is found that hamming is best when compared with theory. So, the result is, when comparing convolution and hamming with BER, convolutional is found to be the best. Third, the performances of AWGN and RAYLEIGH channel are considered for convolutional codes.

The BER performance graph for performances of AWGN and RAYLEIGH channel is given below:

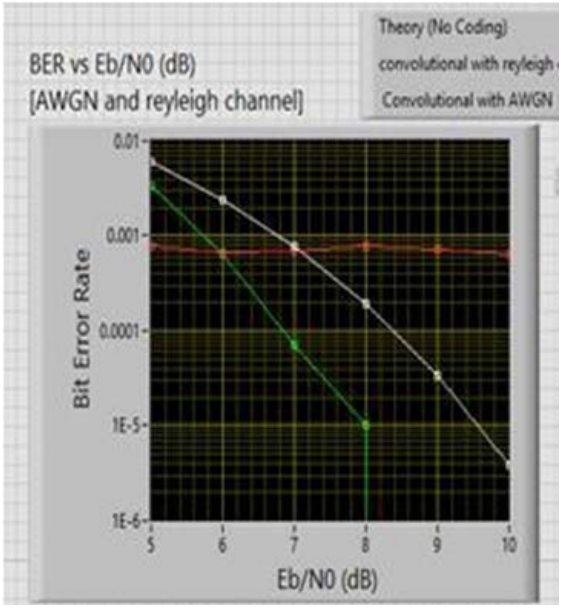

Figure-4. BER performances of AWGN and RAYLEIGH channel in convolutional codes.

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CONCLUSIONS

The coding is designed in order to reduce the BER, reduce the interference and to increase the data through put.

Thus this coding can be used to eliminate the interference. Also the data throughput can be increased by using the better coding technique.

The forthcoming work contains the implementation of several encoding techniques in OFDM. Also the consideration for real time implementation of this code is to be made.

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