

Design of Quadrature Phase Shift Keying Technique On Matlab Simulink

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Abstract— Digital modulation is a process that impresses a digital symbol on to a signal suitable for transmission on a wired or wireless medium in order to receive that signal at receiving end correctly without any loss of information. Quadratic phase shift keying (QPSK) modulation technique is the most widely used modulation scheme in modern digital communication system such as CDMA technology and satellite communication etc.; it provides high performance on bandwidth efficiency and bit error rate. In a sense, QPSK is an expanded version from binary PSK where in a symbol consists of two bits and two orthonormal basis functions are used. A group of two bits is often called a 'dibit'. So, four dibits are possible. Each symbol carries same energy. QPSK modulation has various applications particularly in the design of wireless modem, cellular CDMA communication.. QPSK, modulation is very robust, but requires some form of linear amplification.. In a sense, QPSK is an expanded version from binary PSK where in a symbol consists of two bits and two orthonormal basis functions are used. A two bits group is often called a 'dibit'. So, there are four dibits possible. Each symbol carries same energy. In this paper we shall discuss about the basic block and circuit diagram of QPSK modulator.

Keywords—QPSK, OFDM, BER, M-Array.

1. INTRODUCTION

M-ary Encoding

M-ary term is derived from the binary word.

It simply represents a digit that corresponds to the number of Conditions, levels, or combinations possible for a given number of binary variables.

For example, a digital signal with four possible conditions (Voltage levels, frequencies, phases, and so on) is an M-ary system where $M = 4$. If there are eight possible conditions, $M = 8$ and so forth. The number of bits necessary to produce a given number of conditions is expressed mathematically as

$$N = \log_2 M \quad \text{----- (1)}$$

Where N = number of bits necessary

M = number of conditions, levels, or combinations possible with N bits. Equation 1 can be simplified and rearranged to express the

Number of conditions possible with N bits as

$$2^N = M \quad \text{----- (2)}$$

For example, if one bit, only $2^1 = 2$ conditions are possible. If two bits, $2^2 = 4$ conditions are possible. If three bits, $2^3 = 8$ conditions are possible, etc.

Baud

Baud defines the rate of change of a signal on the transmission medium after encoding and modulation have occurred. Hence, the baud is a unit of transmission rate, modulation rate, or symbol rate and, therefore, it is called as symbols per second and baud are often used interchangeably.

Mathematically, it is the reciprocal of the time of one output signaling element, and a signaling element may represent several information bits. Baud is expressed as $\text{baud} = 1/t_s$ where $\text{baud} = \text{symbol rate (baud per second)}$
 $t_s = \text{time of one signaling element (seconds)}$.

BIT ERROR RATE:

Better accuracy of the transmitted signal is measured by BER, $\text{BER} = \text{Number of Error rates} / \text{Total number of bits}$.

A lower Bit Error rate implies that the signal has been more accurately transmitted & demodulated.

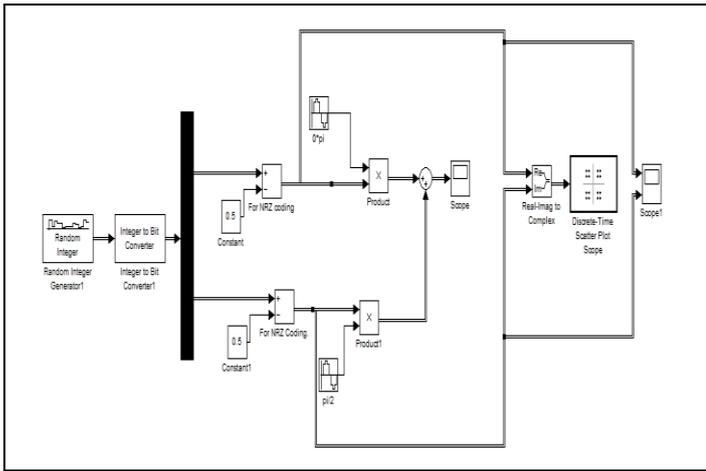


FIG. 1.QPSK SIMULINK MODEL

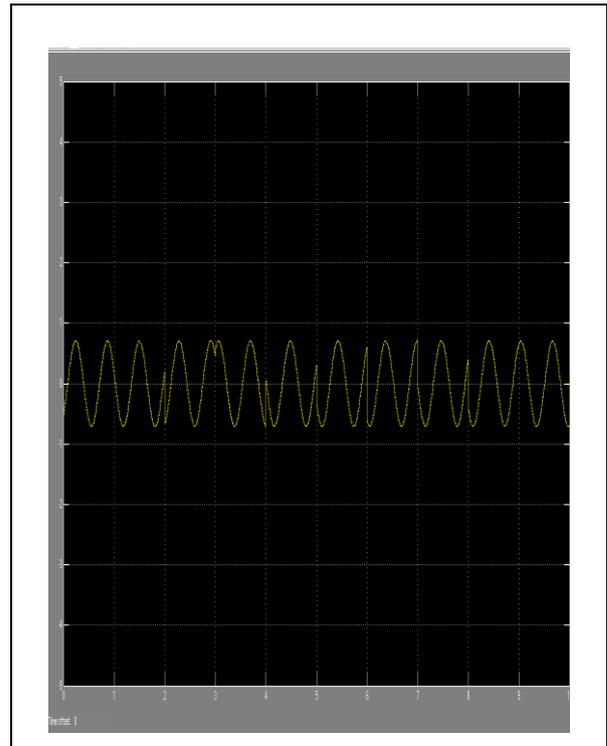


Fig.3.Scope 1 Output

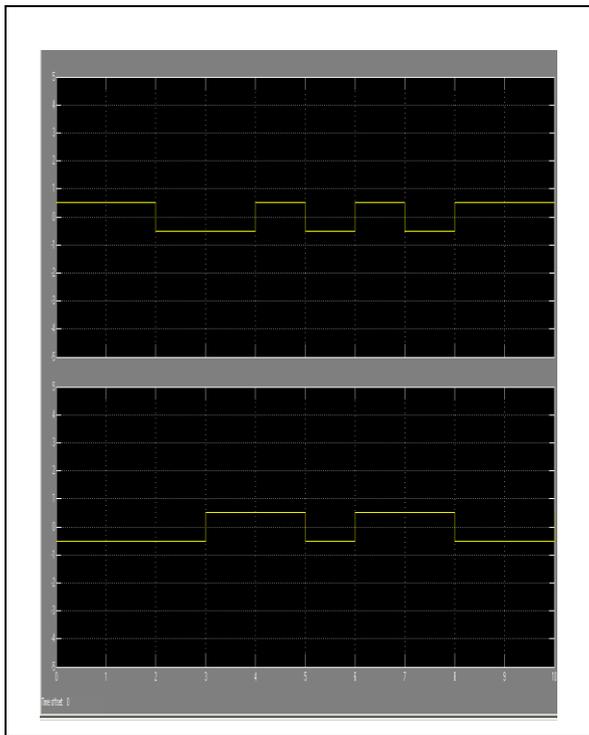


Fig.2.Scope Output

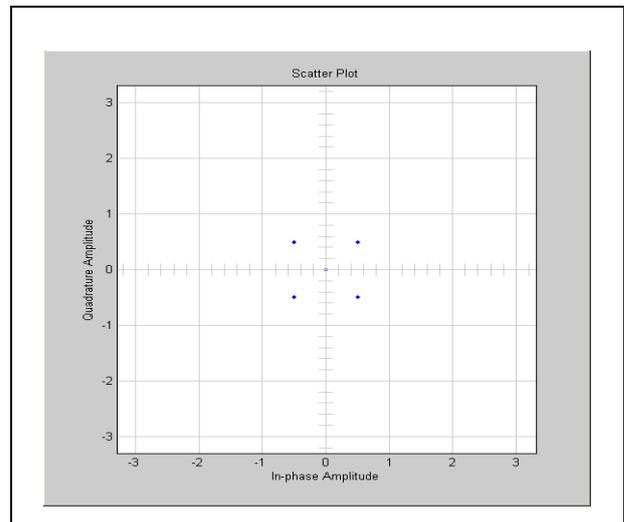


Fig.4.Scatter Plot Output

I. THEORY

The binary data stream is splitted into the two components in-phase and quadrature-phase components. These components are then separately modulated onto two orthogonal basis functions. In this implementation, two

sinusoids are used. After that, the two signals are superimposed, and the resulting signal obtained is the QPSK signal. Note that the use of polar NRZ encoding. These encoders block can be placed before for binary data source, but have been placed after to illustrate the conceptual difference between digital and analog signals involved with digital modulation.

I.1 PN-Sequence generator (Random Generator)

The random bit generator generates a bit sequence (PN-sequence) that is used as input data for our QPSK modulator. A PN-sequence generator circuit is an array of D-flip flops. Various combination of X-OR gates can be used to get various bit sequences.

I.2 Integer to Bit Converter

Map a vector of Integers to a vector of bits. The first bit of the vector is the MSB. The output of bits per integer value defines how many bits are mapped from each integer.

I.3 DEMUX 1

It splits the bits into either

- a) Vector signals into scalars or smaller vector.
- b) Bus signals produced by the MUX block into their constitute scalar, vector or matrix signals.

I.4 NRZ coding

Adds or subtract the inputs either

- a) String containing + or – for each input port, for spacer between ports.
- b) Scalar ≥ 1 . A value > 1 sums all Input; 1 sums elements of a single Input vector.

I.5 Constant Block

Output of constant specified by the constant value parameter. If constant value is a vector & interpret vector parameters as 1-D is on, treat the constant value as a 1-D array otherwise o/p a matrix with the same dimensions as the constant.

Source Block

There are two source block

$0 \cdot \pi$ & $\pi/2$

Output of sine wave

$O(t) = \text{Amp} \cdot (\text{Frequency} \cdot t + \text{Phase}) + \text{Bias}$

Sine type determine the computational technique used. The parameter in the two types are related through

Samples per period = $2 \cdot \pi / (\text{Freq} \cdot \text{Samples})$

No. of Offset Samples = $\text{Phase} \cdot \text{Samples Per period} / (2 \cdot \pi)$.

I.6 Product Block

Multiply & divide the input: Choose element wise or matrix product & specify one of the following

- a) * or / for each input port (eg. **/*)
- b) Scalar specifies the no. of input ports to be multiplied.

I.7 SUM

Adds or subtract the inputs as discussed in NRZ coding.

I.8 Real Image to Complex

Construct a complex output from real & / or Imaginary Input.

II. CONCLUSION

In this paper we have discuss the all blocks used in the QPSK simulink model as shown in Fig.1. In this paper we have to get the output in the Scatter plot which shows that QPSK has a quadrature modulation technique. Also we have seen the different output at different stages in the simulink model in scope output & in scope 1 output. Scope output defines the sum of two bits & scope 1 output defines the phase shift in the bits. Scatter plot scope used to display a modulated signal constellation in its signal space by plotting the In phase component versus the quadrature component after the simulation.

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