SIMULATION OF SIGNAL CONSTELLATIONS OF BPSK, QPSK AND QAM AND THEIR ANALYSIS

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Abstract: Modulation is the process of varying one or more properties of a high frequency periodic waveform, called the carrier signal, with a modulating signal which typically contains information to be transmitted. The main goal of modulation today is to squeeze as much data into the least amount of spectrum possible. That objective, known as spectral efficiency, measures how quickly data can be transmitted in an assigned bandwidth expressed in terms of bits per second per Hz (b/s/Hz). Multiple techniques have emerged to achieve and improve spectral efficiency. There are various analog and digital modulation techniques used to transmit the signals. Due to various advantages of digital signals over analog signals, digital modulation techniques are preferred widely. This paper presents a brief study of different digital modulation methods and their uses for a particular application.

Keyword: baseband, bandwidth, Discrete, guided, manipulated, noise.

I. INTRODUCTION

WDM merges many signals coming on laser beams at infrared (IR) wavelengths for transmission along optical fiber. Each laser is modulated by an autonomous set of signals[2]. WDM boosts the data carrying capacity of an optical fiber by passing an incoming light signals on light frequencies in a certain frequency band. WDM carries each signal autonomously[3]. In this work, we have simulated various modulation techniques. The BER of different modulation formats have been analysed and compared. It has been reported that the PM-QPSK yielded better performance as compared to other modulation formats.

II. LITERATURE SURVEY

Chia-An Yeh, Yen-Shin Lai[4] explained that the resolution of a digital pulse width modulator (DPWM) can be dramatically increased by either constant on-time modulation control or constant off-time modulation control as compared to that for constant frequency modulation. However, the switching frequency increases dramatically for the constant on/off-time modulation method under heavy/light load conditions, respectively. The increase of switching frequency results in more switching losses and requires a higher performance controller.

R.Gandhiraj, Ranjini Ram, K.P.Soman [5] presented a small tutorial for the new users in the field of software defined radio. Applications are build up using graphical user interface called the GNU radio companion (GRC). The idea behind developing such a tool kit is to give practical exposure in the communication concepts like basic signal generations, signal operations, multi-rate concepts, analog and digital modulation schemes and finally multiplexing schemes with the help of GNU radio. Unlike MATLAB Simulink or Labview GNU radio is open source i.e. free of cost and the concepts can be easily reached to the normal people without much of programming concepts using the pre written blocks. And programmers also have the chance to write their own applications.

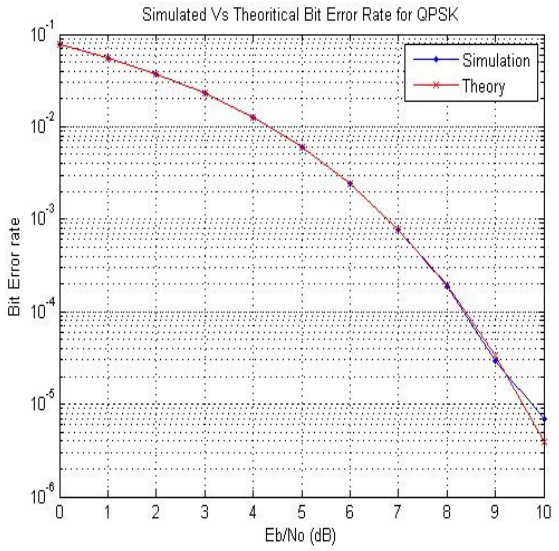
Yung Nguyen, Hobraiche, J.,Patin, N. , Friedrich, G., Vilain, J.[6] presented direct digital technique-generalized discontinuous pulse width modulation (PWM) - a new implementation method for an optimal discontinuous PWM (DPWM) in terms of switching losses of the inverter on an embedded system. At each sampling period, an optimal choice is done in order to clamp one of the three half-bridges. Its advantages compared to classic ones (DPWM) are as follows: needless to know the load power factor, operational under steady-state and dynamic operating conditions, and low computation time.

K.S. Chong, E. Zahedia,, K.B. Gan, M.A. Mohd. Ali,[7] employed delta modulation (DM) as a compression technique for a high-resolution photo plethysmogram (PPG) signal. To
accommodate both clean PPG and signals affected by motion artifacts, the effect of step size is evaluated on the performance of DM in order to optimize this technique before it can be
deployed in a wireless data acquisition system. To this end, the PPG was recorded using 16-bit analog-to-digital converter (ADC) at a 1000 Hz sampling rate. In order to take into consideration the effect of the DC and AC of the PPG during the performance evaluation, both the PRMSAC+DC (with DC component) and PRMSAC (without DC component) were estimated.

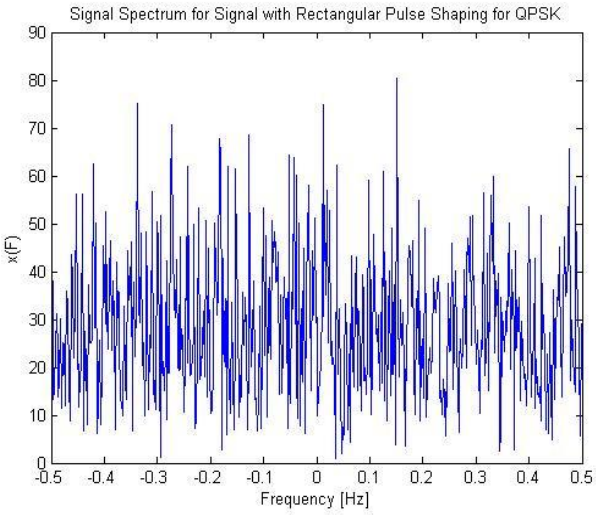
III. SIMULATION

Phase-shift keying is a digital modulation process which conveys data by changing the phase of a constant frequency reference signal. The modulation is accomplished by varying the sine and cosine inputs at a precise time. It is widely used for wireless LANs, RFID and Bluetooth communication. Quadrature Phase Shift Keying (**QPSK**) is a form of Phase Shift Keying in which two bits are modulated at once, selecting one of four possible carrier phase shifts (0, 90, 180, or 270 degrees). **QPSK** allows the signal to carry twice as much information as ordinary PSK using the same bandwidth[9].

SIMULATED VS THEORITICAL BIT ERROR RATE FOR QPSK:

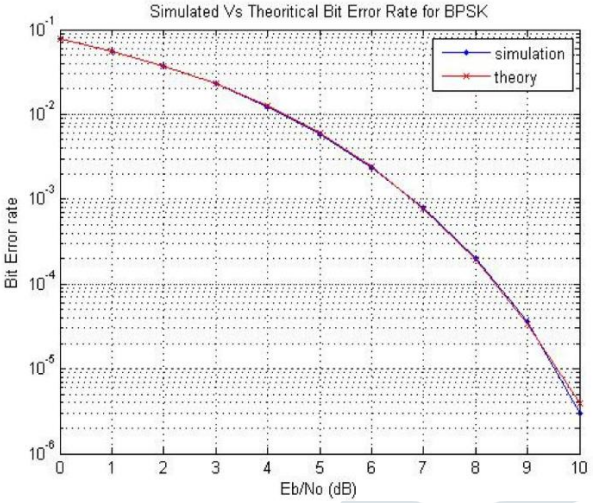


SIGNAL SPECTRUM FOR SIGNAL WITH RECTANGULAR PULSE SHAPING FOR QPSK:

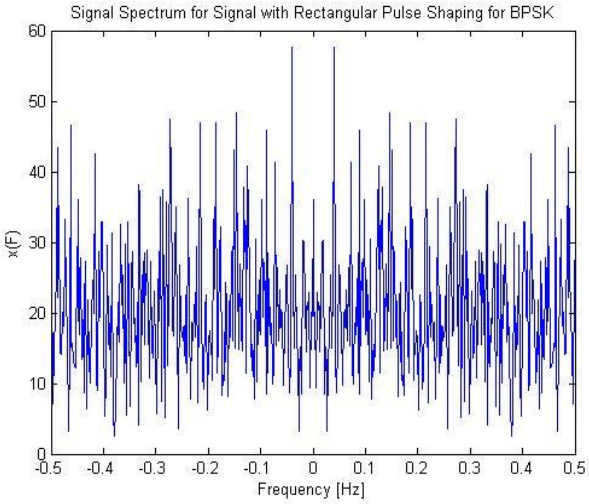


Binary Phase Shift Keying (**BPSK**) is a two-phase modulation scheme, where the 0's and 1's in a binary message are represented by two different phase states in the carrier signal: for binary 1 and. for binary 0. In digital modulation techniques, a set of basis functions are chosen for a particular modulation scheme[10].

SIMULATED VS THEORTICAL BIT ERROR RATE FOR BPSK:

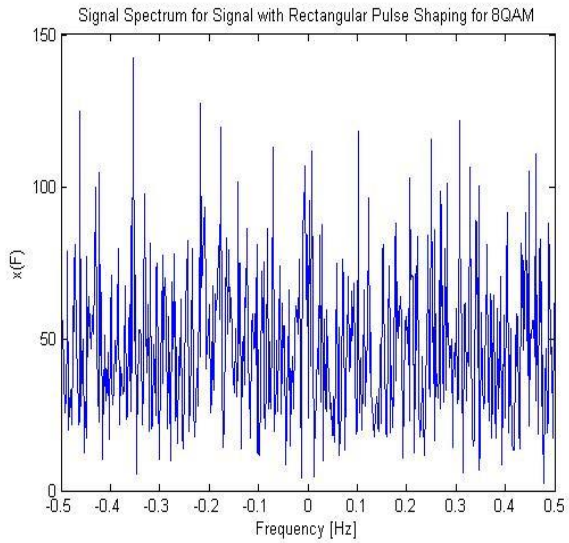


RECTANGULAR PULSE SHAPING FOR BPSK:

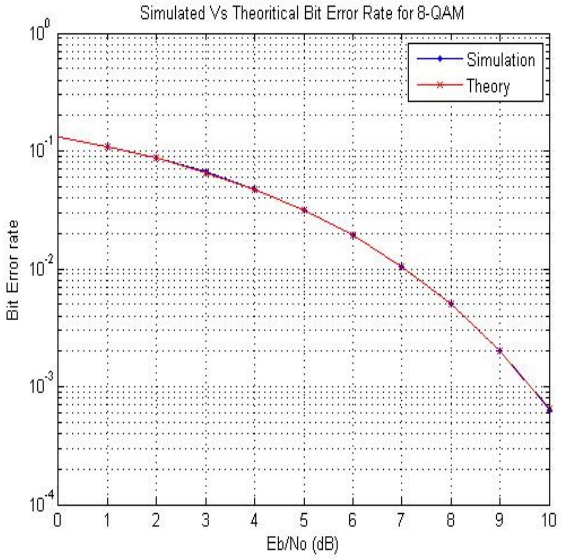


QAM (quadrature amplitude modulation) is a method of combining two amplitude-modulated (AM) signals into a single channel, thereby doubling the effective bandwidth. **QAM** is used with pulse amplitude modulation (PAM) in digital systems, especially in wireless applications[11].

SIGNAL SPECTRUM FOR SIGNAL WITH RECTANGULAR PULSE SHAPING FOR 8 QAM:



SIMULATED VS THEORITICAL BIT ERROR RATE FOR 8- QAM:



IV. CONCLUSION

An analysis of the digital modulation technique carried out in this article reveals that the selection of a digital modulation technique is solely dependent on the type of application. This is because of the fact that some of the technique provide lesser complexities in the design of the modulation and demodulation system and prove economic and can be visualized for the systems which really does not require high amount of precisions or when economy is the major aspect and the BER performances can be tolerated.

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