Implementation of Binary Shift Keying Techniques

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***Abstract*— Modulation and Demodulation is a key feature in wireless communication for data transmission. Digital modulation techniques play an efficient role in performing modulation process. Binary Shift Keying (BSK) is one of the existing techniques. Demodulation is the inverse operation of modulation performed to retrieve the original data signal. BSK technique includes Binary Amplitude Shift Keying (BASK), Binary Frequency Shift Keying (BFSK), Binary Phase Shift Keying (BPSK). Verilog HDL is used to implement the proposed techniques which were successfully simulated on Modelsim platform for checking functional verification. RTL simulation results are presented in this journal.**

***Keywords*— BASK, BFSK, BPSK, Demodulation, Modulation.**

I. INTRODUCTION

Modulation is very important block in communication system to transmit information through channel without any loss of data. Different modulators are being developed to meet requirements like low power, bandwidth efficient etc., This journal describes the purpose of implementing this kind of technique.

There are 3 major categories of Digital modulation techniques used to transfer digitally represented data:
- Amplitude Shift Keying (ASK)
- Frequency Shift Keying (FSK)
- Phase Shift Keying (PSK)

A. Binary Amplitude Shift Keying (BASK)

Amplitude-shift keying (ASK) is a form of modulation that represents digital data as variations in the amplitude of a carrier wave. Any digital modulation scheme uses a finite number of distinct signals to represent digital data. ASK uses a finite number of amplitudes, each assigned a unique pattern of binary digits. Usually, each amplitude encodes an equal number of bits. Each pattern of bits forms the symbol that is represented by the particular amplitude. The demodulator, determines the amplitude of the received signal and maps it back to the symbol it represents, thus recovering the original data. Here, frequency and phase of the carrier are kept constant. A binary amplitude-shift keying (BASK) signal can be defined by

$$s(t) = A\, m(t) \cos 2\prod fct,\ 0 < t < T$$

where A is a constant, m(t) = 1 or 0, *fc* is the carrier frequency, and *T* is the bit duration.

B. Binary Frequency Shift Keying (BFSK)

Frequency-shift keying (FSK) is a frequency modulation scheme in which digital information is transmitted through discrete frequency changes of a carrier wave. The simplest FSK is binary FSK (BFSK). BFSK uses a pair of discrete frequencies to transmit binary (0s and 1s) information. With this scheme, the "1" is called the mark frequency and the "0" is called the space frequency.

A BFSK signal can be expressed as

$$S_{BFSK}(t) = A\sin\left\{2\pi\left[f_c + m(t)f_m\right]t + \Phi_0\right\},\quad 0 \le t \le T,$$

Where, m(t) =0 or 1, binary message

T =bit duration

A, fc, φ_0 are the amplitude, frequency and phase of the sinusoidal carrier signal

C. Binary Phase Shift Keying (BPSK)

Phase Shift Keying (PSK) is a digital modulation scheme that conveys data by changing or modulating phase of carrier signal. BPSK is also called as (PRK) Phase Reversal Keying or 2PSK. It is the simplest form of PSK. It uses two phases which are separated by 180° and so can also be termed 2-PSK. It does not particularly matter exactly where the constellation points are positioned and they can be shown on the real axis at 0° and 180°. The general form for BPSK follows the equation:

$$s_n(t) = \sqrt{\frac{2E_b}{T_b}} \cos(2\pi f_c t + \pi(1-n)), n = 0, 1.$$

II. SIMULATION ANALYSIS

A. BASK

In BASK, the amplitude of the sinusoidal carrier signal is changed according to the message level ("0" or "1"), while keeping the phase and frequency constant.

The following figure represents the block diagram of BASK:

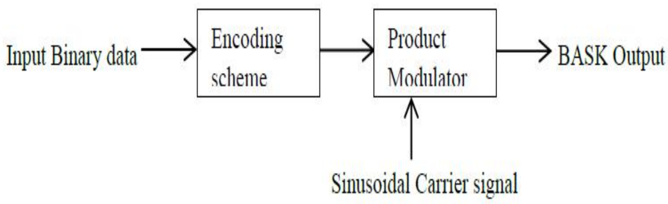

Fig. 1: Block diagram of BASK

The following figure represents the waveform of BASK:

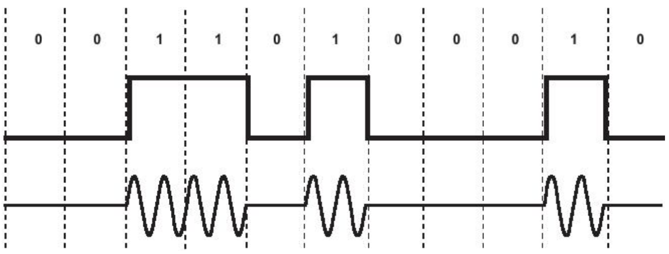

Fig. 2: BASK signal waveforms

B. BFSK

In BFSK, the frequency of the sinusoidal carrier signal is changed according to the message level ("0" or "1"), while keeping the phase and amplitude constant. The following figure represents the block diagram of BFSK:

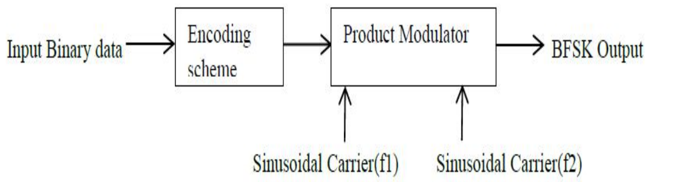

Fig. 3: Block diagram of BFSK

The following figure represents the waveform of BFSK:

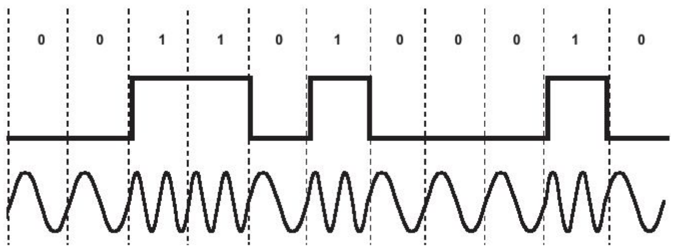

Fig. 4: BFSK signal waveforms

C. BPSK

In BPSK, the phase of the sinusoidal carrier signal is changed according to the message level ("0" or "1"), while keeping the frequency and amplitude constant. The following figure represents the block diagram of BPSK:

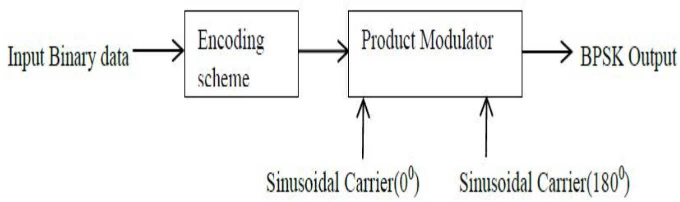

Fig. 5: Block diagram of BPSK

The following figure represents the waveform of BPSK:

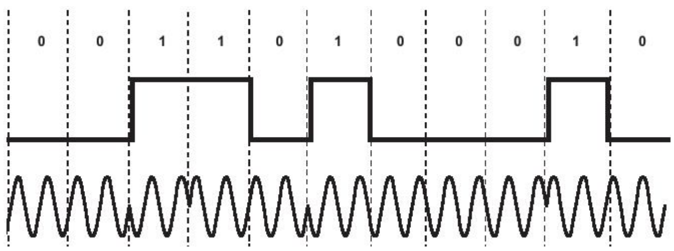

Fig. 6: BPSK signal waveforms

III. RESULTS AND CONCLUSION

Simulation results for the shift keying techniques are presented in this paper. This application can be further developed by combining modulation process with Pulse Position Modulation (PPM) when transmitting and receiving convolutionally coded data to increase its applications.

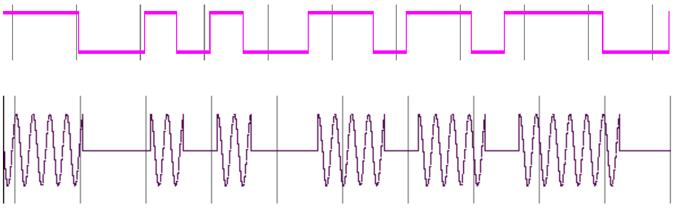

Fig. 7: BASK simulation result

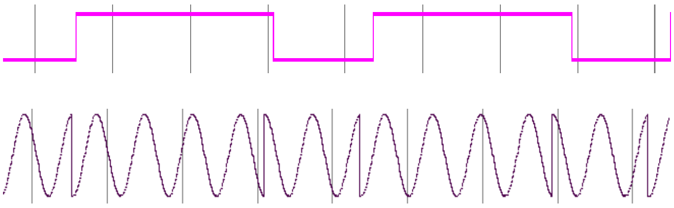

Fig. 8: BPSK simulation result

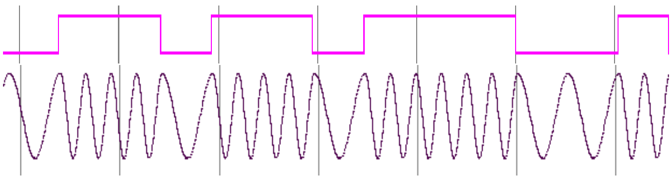

Fig. 9: BFSK simulation result

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