EXPERIMENT NO. 6

AIM: Simulation program to implement Binary Phase Shift Keying (BPSK) with noise.

OBJECTIVE: Write a program to study BPSK on MATLAB.

APPARATUS /SW: MATLAB Version _______.

THEORY:

Binary Phase Shift Keying

In BPSK, individual data bits are used to control the phase of the carrier. During each bit interval, the modulator shifts the carrier to one of two possible phases, which are 180 degrees or π radians apart. This can be accomplished very simply by using a bipolar baseband signal to modulate the carrier 's amplitude, as shown in Figure . The output of such a modulator can be represented mathematically as

$$x(t) = R(t)\cos(\omega_c t + \theta)$$

where $R(t)$ is the bipolar baseband signal, ω_c is the carrier frequency, and θ is the phase of the unmodulated carrier. If the output of the modulator is to be represented in complex-envelope form referenced to the carrier frequency, the modulated signal is given as

$$\tilde{x}(t) = I(t) + jQ(t)$$

where

$$\begin{aligned} I(t) &= R(t)\cos\theta \\ Q(t) &= R(t)\sin\theta \end{aligned}$$

In the special case of $\theta = 0$, Eq. (9.3.2) reduces to

$$\tilde{x}(t) = R(t)$$

and the real-valued baseband signal can be used directly as the complex-envelope representation of the modulator output. However, to allow for subsequent phase shifting, the signal's complex-envelope representation should always be implemented as a complex-valued signal. For the special case of $\theta = 0$, the imaginary part of the complex signal is simply set to zero.

BPSK Modulator:

For all but the highest data rates, it is usually sufficient to model the multiplier in Figure 9.18 as ideal, with all of the modulator's nonideal behavior being attributed to degradations of the baseband data waveform. Two different BPSK models are provided on the Web site. The model `BpskBandpassModulator`, summarized in Table 9.8, implements Eq. (9.3.1) to produce a real-valued bandpass output signal. The file `bpsk_mod.cpp` contains the model `BpskModulator`, summarized in Table 9.9, which produces a complex-valued lowpass output signal.

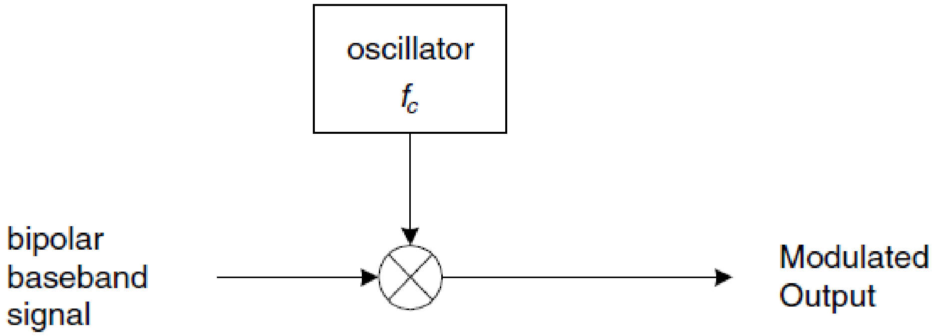


Figure 9.18 BPSK modulator.

BPSK Demodulation:

A correlation receiver for BPSK is shown in Figure 9.19. The modulated signal is multiplied by the recovered carrier, and this product is integrated over a bit interval. If the integration result is positive, the received bit is deemed to be 1; if the integration result is negative, the received bit is deemed to be 0. The BPSK demodulator models provided on theWeb site include only those functions shown inside the dotted box of the figure. Carrier recovery and clock recovery are provided by separate model, summarizes the model `BpskBandpassDemod`, which accepts as input a real-valued bandpass input signal. The recovered carrier input to the model is in the form of a real-valued sinusoid, and the recovered clock input to the model is in the form of an integer-valued sequence that has zero values everywhere except at the sampling instants corresponding to the end of each bit interval.

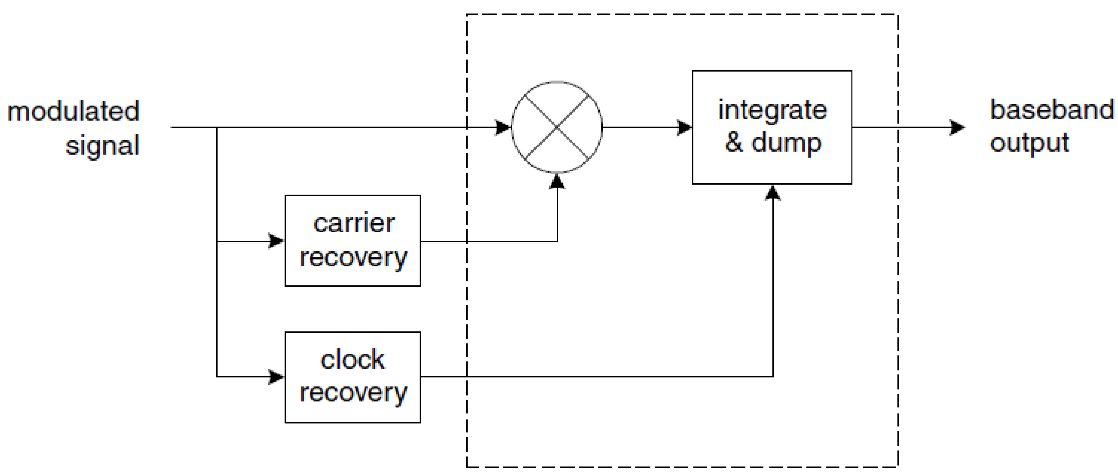
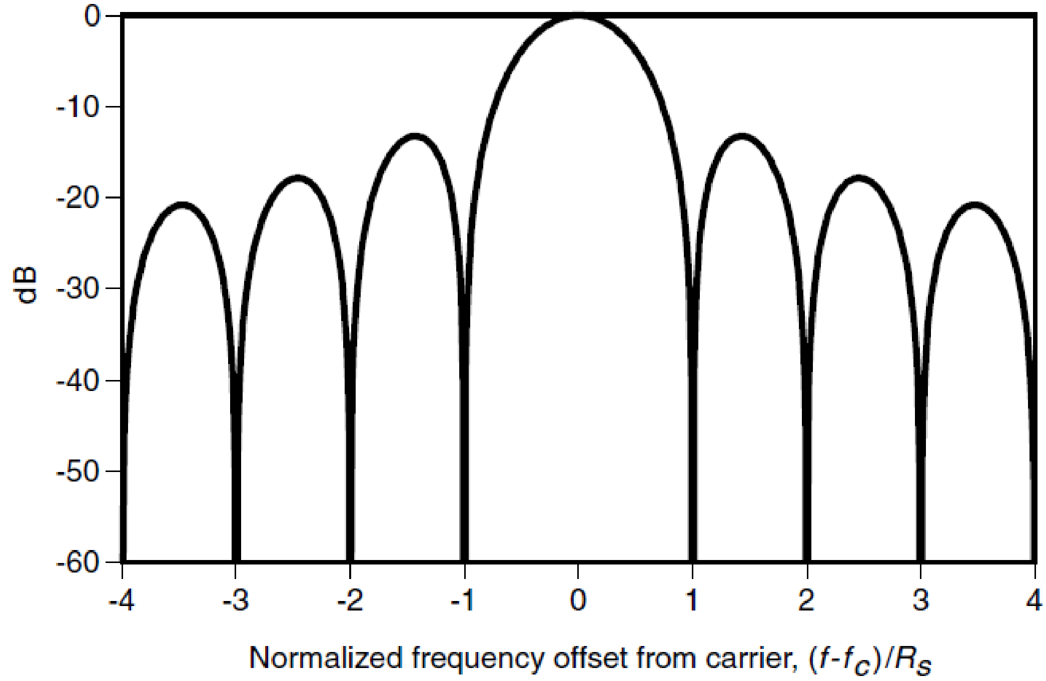


Figure 9.19 Correlation receiver for BPSK.

input a complex envelope representation of the modulated signal. The recovered carrier input to the model is in the form of a real-valued signal that represents the instantaneous phase of the recovered carrier. As it is for the bandpass model, the recovered clock input is in the form of an integer-valued sequence that has zero values everywhere except at the sampling instants corresponding to the end of each bit interval.

Spectrum of BPSK:



Flowchart: Draw on blank page

Algorithm: Draw on blank page

Program: Attach the Printout of Program

Input, Output, Result: Attach the printout of Input Output and Result.

Conclusion:

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Questions:

Write mathematical expression of BPSK?

Draw a signal space diagram of BPSK?

Draw spectrum of BPSK?

Timely submission (10)	Journal Presentation(10)	Performance(10)	Understanding(10)	Oral(10)	Total (50)
Sub Teacher Sign:					