Introduction:

Modulation is the process of varying one or more properties of a periodic waveform, called the carrier signal, with a modulating signal that typically contains information to be transmitted telecommunications, modulation is the process of conveying a message signal, for example a digital bit stream or ananalog audio signal, inside another signal that can be physically transmitted. Modulation of a sine waveform transforms a baseband message signal into a passband signal. The tower and its accompanying radio station were built in 1938 at a cost of over $300,000 by **Edwin Howard Armstrong**, pioneer radio inventor, to demonstrate the superiority of his new system of radio broadcasting—frequency modulation (FM).

.Amplitude modulation (AM) is a modulation technique used in electronic communication, most commonly for transmitting information via a radio carrier wave. In amplitude modulation, the amplitude (signal strength) of the carrier wave is varied in proportion to the waveform being transmitted. That waveform may, for instance, correspond to the sounds to be reproduced by a loudspeaker, or the light intensity of television pixels. This technique contrasts with frequency modulation, in which the frequency of the carrier signal is varied, and phase modulation, in which its phase is varied.

AM was the earliest modulation method used to transmit voice by radio. It was developed during the first two decades of the 20th century beginning with Roberto Landell De Moura and Reginald Fessenden's radiotelephone experiments in 1900. It remains in use today in many forms of communication; for example it is used in portable two way radios

Amplitude modulation is classified as :

- AM(Amplitude modulation)
- PM(Phase modulation)
- FM(Frequency modulation)
- SSB(Single sideband)
- ASK(Amplitude shift key)
- PSK(Phase shift key)
- QAM(Quadrature amplitude modulation)

Here we have to fully concentrate & explain by MATLAB programming on amplitude modulation in PSK.

Theoretical Background:

Phase-shift keying (PSK) is a digital modulation scheme based on changing, or modulating, the initial phase of a carrier signal. PSK is used to represent digital information, such as binary digits zero (0) and one (1).

PSK is typically applied in wireless local area networks (WLAN), Bluetooth technology and radio frequency identification (RFID) standards used in biometric passport and contactless payment systems. Phase shift keying, PSK, is widely used these days within a whole raft of radio communications systems. It is particularly well suited to the growing area of data communications. PSK, phase shift keying enables data to be carried on a radio communications signal in a more efficient manner than Frequency Shift Keying, FSK, and some other forms of modulation.

With more forms of communications transferring from analogue formats to digital formats, data communications is growing in importance and along with it the various forms of modulation that can be used to carry data.

There are several flavours of phase shift keying, PSK that are available for use. Each form has its own advantages and disadvantages, and a choice of the optimum format has to be made for each radio communications system that is designed. To make the right choice it is necessary to have a knowledge and understanding of the way in which PSK works.

Classification:

Two common PSK types are as follows:

- **Quadrature Phase-Shift Keying (QPSK)**:

  In digital modulation techniques a set of basis functions are chosen for a particular modulation scheme. Generally the basis functions are orthogonal to each other. The term Q for Quadrature comes from the use of quadrants or four spaces. The values shown are in dBmV which is decibel kilovolts or power values used in a data transmission. The use of quadrants and individual points called constellations improves performance and throughput even with signal interference from electrical noise, lighting systems, status and other sources. Constellations are used extensively in modem technology to improve speed and reduce errors.

  Uses four phases to encode two bits per symbol.

- **Binary Phase-Shift Keying (BPSK)**:
- BPSK (also sometimes called PRK, Phase Reversal Keying, or 2PSK) is the simplest form of phase shift keying (PSK). It uses two phases which are separated by 180 degrees and so can also be termed 2-PSK. It does not particularly matter exactly where the constellation points are positioned and in this figure they are shown on the real axis, at 0 degrees and 180 degrees. This modulation is the most robust of all the

PSKs since it takes the highest level of noise or distortion to make the demodulator reach an incorrect decision. It is, however, only able to modulate at 1 bit/symbol (as seen in the figure) and so is unsuitable for high data-rate applications.

In phase shift keying (PSK), the phase of a carrier is changed according to the modulating waveform which is a digital signal. InBPSK, the transmitted signal is a sinusoid of fixed amplitude. It has one fixed phase when the data is at one level and when the data is at the other level, phase is different by 180 degree. A Binary Phase Shift Keying(BPSK) signal can be defined as

$$V_{BPSK}(t) = b(t)\sqrt{2P}\cos 2\pi f_c t, \text{ where } 0<t<T$$

In the presence of an arbitrary phase-shift introduced by the communications channel, the demodulator is unable to tell which constellation point is which. As a result, the data is often differentially encoded prior to modulation.

Simplest PSK type. Uses two phases separated by 180 degrees.

Properties:

- Any digital modulation theme uses a finite variety of distinct signals to represent digital knowledge. PSK uses a finite variety of phases, every assigned a singular pattern of binary digits. Usually, every part encodes Associate in Nursing equal variety of bits. Every pattern of bits forms the image that's painted by the actual part.
- The rectifier, which is intended specifically for the symbol-set utilized by the modulator, determines the part of the received signal and maps it back to the image it represents, so sick the initial knowledge. this needs the receiver to be ready to compare the part of the received signal to a reference signal — such a system is termed coherent (and said as CPSK).
- Phase-shift keying (PSK) could be a digital modulation theme that conveys information by dynamical, or modulating, the section of a reference signal.

Advantages:

- There are several variations of PSK. Each variation has its own advantages and disadvantages, which enable designers to choose the best one for the particular application they are working on.
- Quadrature phase shift keying is another form of data transport where four phase states are used, all within 90 degrees of one another.
- The main advantage of phase shift keying is that it allows data to be carried along a radio communications signal much more efficiently than with frequent shift keying.
- PSK is a digital modulation scheme that transports data by changing the phase of the carrier wave.

- Power efficiency. System is the simplest
- PSK is less susceptible to errors than ASK, while it requires/occupies the same bandwidth as ASK.
- Phase modulation is a version of frequency modulation where the phase of the carrier wave is modulated to encode bits of digital information in each phase change.

Disadvantages:

- Low bandwidth efficiency.
- More complex signal detection / recovery process, than in ASK and FSK.
- The disadvantage of QPSK relative to BPSK is that is more sensitive to phase variations.
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Application:

- It has less bandwidth compared to any other digital modulation , so it is used in application which Less bandwidth.
- In radio, amplitude modulation takes a huge turn into complexity land because of its various Applications and uses in both analog and digital radio.
- Transmitter & receiver has o synchronized very often, e.g. by using special synchronization Patterns before user data arrives or via a plot frequency as reference.

Mathematical Explanation:

PSK – phase of carrier signal is varied to represent binary 1 or 0

Peak amplitude & freq. remain constant during each bit interval

Example: binary 1 = 0º phase, binary 0 = 180º (πrad) phase

PSK is equivalent to multiplying carrier signal by +1 when the information is 1, and by -1 when the information is 0.

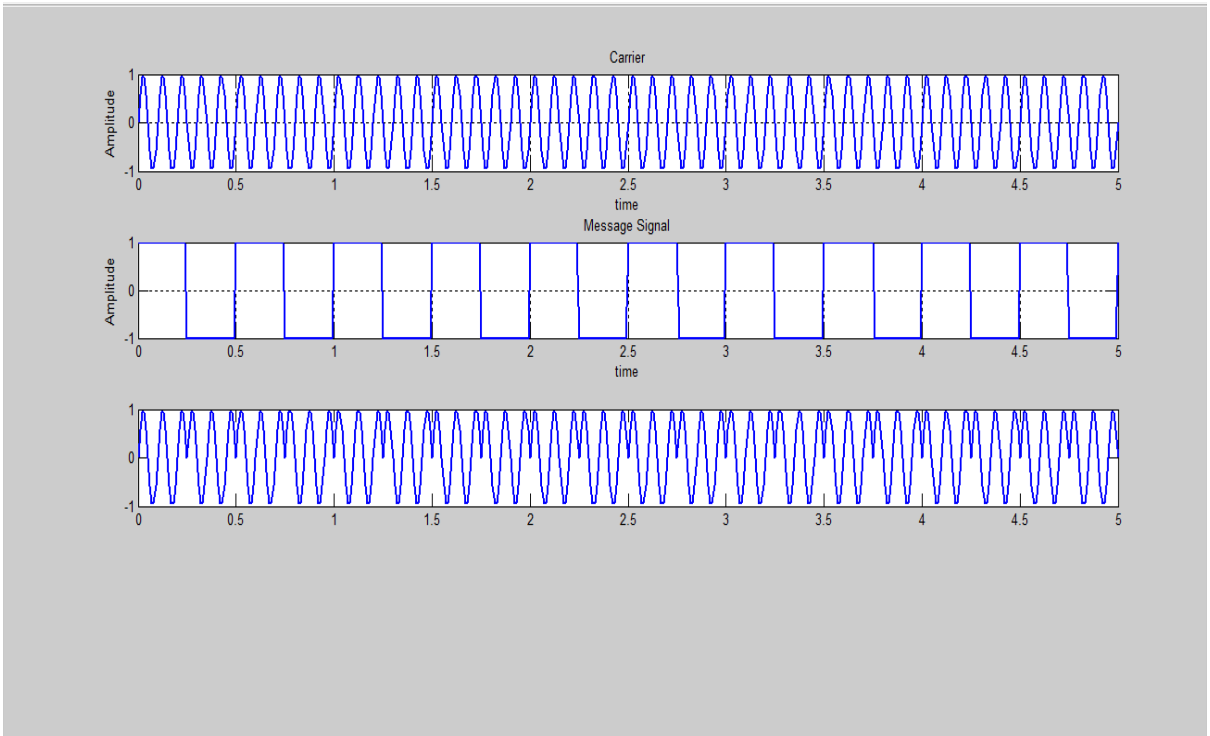
$$s(t) = \begin{cases} A\cos(2\pi f_c t), & \text{binary 1} \\ A\cos(2\pi f_c t + \pi), & \text{binary 0} \end{cases}$$

$$s(t) = \begin{cases} A\cos(2\pi f_c t), & \text{binary 1} \\ -A\cos(2\pi f_c t), & \text{binary 0} \end{cases}$$

Programming:

```
clear all;
clc;
close all;
set(0,'defaultlinelinewidth',2)
;
A=[0001];[1001];[0110];[1000];[
0011];[0010];[0001];[1001];[011
0];[1000];[0011];[0010];[0010];
[0011];[1000];[0110];[1001];[00
01];
t=0:.01:5;
f1=input('Carrier Sine wave
frequency =');
f2=input('Message frequency
=');
x=A.*sin(2*pi*f1*t);%Carrier
Sine
subplot(4,1,1);
plot(t,x);
xlabel('time');
ylabel('Amplitude');
title('Carrier');
grid on;
u=square(2*pi*f2*t);%Message
signal
subplot(4,1,2);
plot(t,u);
xlabel('time');
ylabel('Amplitude');
title('Message Signal');
grid on;
v=x.*u;%Sine wave multiplied
with square wave
subplot(4,1,3);
plot(t,v);
axis([0 1]);
xlabel('t');
ylabel('y');
title('PSK');
grid on;
z =x.*v;%square wave frequency
multiplied Message frequency
subplot(4,1,4);
plot(t,z);
axis([0 1]);
xlabel('t');
ylabel('y');
title('PSK demodulation');
grid on;
```

Result:



Conclusion:

PSK is modulation technique in which the phase of carrier wave changes per the unit data.