# Lab 07
# Analog Signal Generation using Digital Data in Matlab

## OBJECTIVES OF THE LAB

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In this lab, we will cover the following topics:

- Understand matlab program for ASK & BFSK
- and test it for different user inputs

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## 7.1 AMPLITUDE SHIFT KEYING (ASK)

In ASK, the two binary values are represented by two different amplitudes of the carrier frequency. Commonly, one of the amplitudes is zero, i.e. one binary digit is represented by the presence, at constant amplitude, of the carrier; while the other is represented by the absence of the carrier. The resulting transmitted signal for one bit time is

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

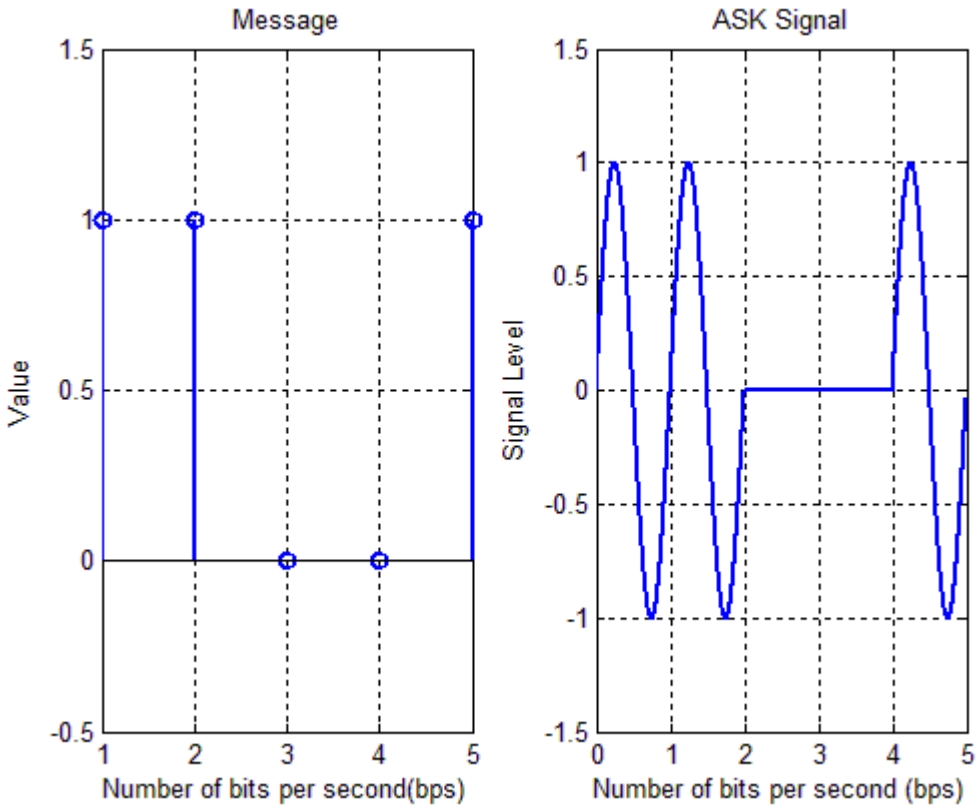
where carrier signal is $A\cos(2\pi f_c t)$.

**Matlab Code for Amplitude Shift Keying (ASK):**

```
clc
clear all

% taking input message from user
message = input('Enter binary data with spaces eg: [1 1 0 0 1] : ');

f_one = 1;                      % frequency of sinusoid for binary-1
fs = 1000;                      % sampling frequency
t = [0:1/fs:1];                 % time duration for 1-pulse
x = sin(2*pi*f_one*t);          % sinusoid for binary-1
y = zeros(1,length(t));         % Zero level signal for binary-0

% generating timing vector
tim = t;
for(i=1:length(message)-1)
   tim = [tim i+t];
end

% creating ASK signal
ask_sig = [];
for i=1:length(message)
   if(message(i) == 0)
      ask_sig = [ask_sig y];
   else
      ask_sig = [ask_sig x];
   end
end

% plotting ASK signal w.r.t timing vector
figure;
subplot(121);
stem(message, 'linewidth', 2);
```

```
title('Message');
xlabel('Number of bits per second (bps)');
ylabel('Value');
axis([1 length(message) -0.5 1.5]);
grid on;
subplot(122);
plot(tim(1,1:(length(message)*fs)),ask_sig(1,1:(length(message)*fs)),'linew
idth', 1.5);
title('ASK Signal');
xlabel(' Number of bits per second (bps)');
ylabel('Signal level');
axis([0 length(message) -1.5 1.5]);
grid on;
```

**Output Signal:**




----------**TASK 01**----------

Write matlab code for Amplitude Shift Keying (ASK) using the following message:

[0 0 1 1 1 0 0 1 0 1]

## 7.2 BINARY FREQUENCY SHIFT KEYING (BFSK)

In BFSK, the two binary values are represented by two different frequencies near the carrier frequency. The resulting transmitted signal for one bit time is

$$s(t) = \begin{cases} A\cos(2\pi f_1 t) & ,binary\ \ 1 \\ A\cos(2\pi f_2 t) & ,binary\ \ 0 \end{cases}$$

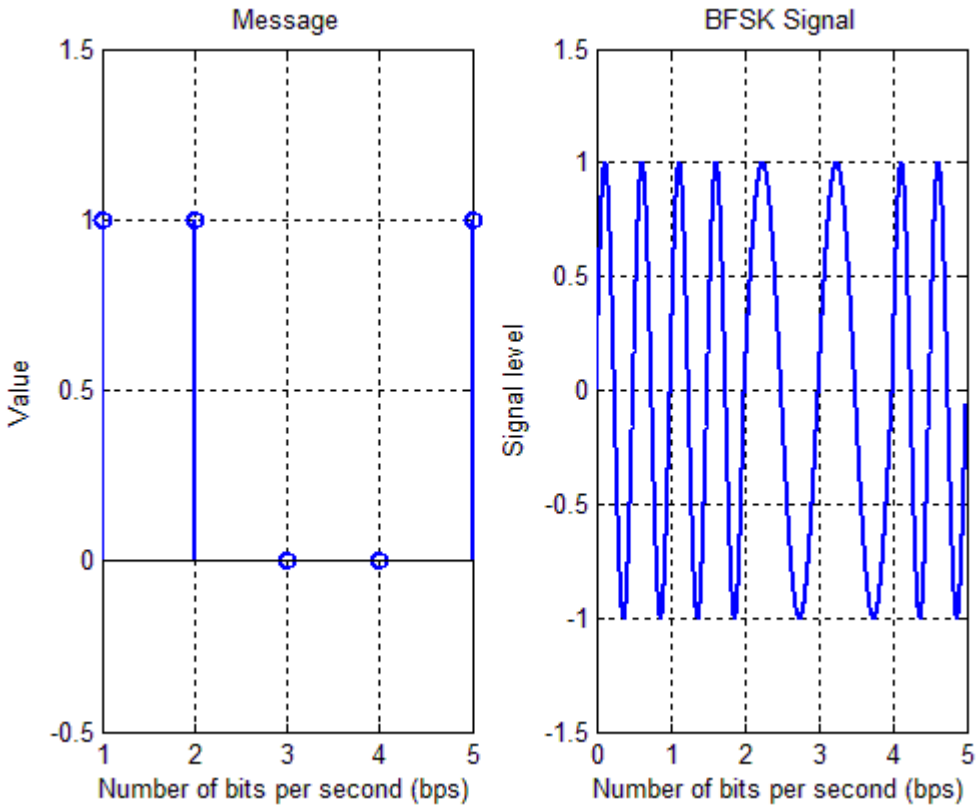
where $f_1$ and $f_2$ are typically offset from the carrier frequency $f_c$ by equal but opposite amounts.

**Matlab Code for Binary Frequency Shift Keying (BFSK):**

```
clc
clear all

% taking input message from user
message = input('Enter binary data with spaces eg: [1 1 0 0 1] : ');

f1 = 1;                 % frequency for binary-0
f2 = 2;                 % frequency for binary-1
fs = 1000;              % sampling frequency
t = [0:1/fs:1];         % time duration for 1-pulse
x = sin(2*pi*f2*t);     % sinusoid representing binary-1
y = sin(2*pi*f1*t);     % sinusoid representing binary-0

% generating timing vector
tim = t;
for(i=1:length(message)-1)
   tim = [tim i+t];
end

% creating BFSK signal
fsk_sig = [];
for i=1:length(message)
   if(message(i) == 0)
      fsk_sig = [fsk_sig y];
   else
      fsk_sig = [fsk_sig x];
   end
end

% plotting BFSK signal w.r.t timing vector
```

```
figure;
subplot(121);
stem(message, 'linewidth', 2);
title('Message');
xlabel('Number of bits (bps)');
ylabel('Value');
axis([1 length(message) -0.5 1.5]);
grid on;
subplot(122);
plot(tim(1,1:(length(message)*1000)),fsk_sig(1,1:(length(message)*1000))
, 'linewidth', 1.5);
title('BFSK Signal');
xlabel('Number of bits (bps)');
ylabel('Signal level');
axis([0 length(message) -1.5 1.5]);
grid on;
```

**Output Signal:**



## ----------TASK 02----------

Write matlab code that generates Binary Frequency Shift Keying (BFSK) signal using the following message:

[1 0 0 1 0 1 0 0 1]