

Data Communications

Modulation

Amplitude, Phase, and Frequency properties of a carrier can be changed to add data to signal (modulation).

In the example below, amplitude shift keying (ASK) is used for modulation. Examine the code and run it using MATLAB.

```
% MATLAB Script for a Binary ASK with two Amplitude Levels

format long;

% Clear all variables and close all figures
clear all;
close all;

% The number of bits to send
N = 8;

% Generate a random bit stream
bit_stream = round(rand(1,N));

% Enter the two Amplitudes
% Amplitude for 0 bit
A1 = 3;

% Amplitude for 1 bit
A2 = 5;

% Frequency of Modulating Signal
f = 1;

% Sampling rate - This will define the resolution
fs = 100;

% Time for one bit
t = 0: 1/fs : 1;

% This time variable is just for plot
time = [];

ASK_signal = [];
Digital_signal = [];

for ii = 1: 1: length(bit_stream)

    % The ASK Signal
    ASK_signal = [ASK_signal (bit_stream(ii)==0)*A1*sin(2*pi*f*t)+...
        (bit_stream(ii)==1)*A2*sin(2*pi*f*t)];
```

```

% The Original Digital Signal
Digital_signal = [Digital_signal (bit_stream(ii)==0)*...
    zeros(1,length(t)) + (bit_stream(ii)==1)*ones(1,length(t))];

time = [time t];
t = t + 1;

end

% Plot the ASK Signal
subplot(2,1,1);
plot(time,ASK_signal,'LineWidth',2);
xlabel('Time (bit period)');
ylabel('Amplitude');
title('ASK Signal with two Amplitudes');
%axis([0 time(end) 1.5 1.5]);
grid on;

% Plot the Original Digital Signal
subplot(2,1,2);
plot(time,Digital_signal,'r','LineWidth',2);
xlabel('Time (bit period)');
ylabel('Amplitude');
title('Original Digital Signal');
axis([0 time(end) -0.5 1.5]);
grid on;

```

Modify the code to modulate the data by changing frequency (FSK). Plot the resulted signal together with digital signal and ASK signal.