Experiment - 3

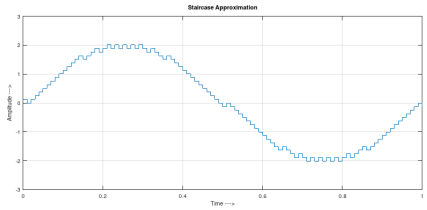
Aim: To Study Delta Modulation (DM) and Study Probability of Error using Matlab/Octave.

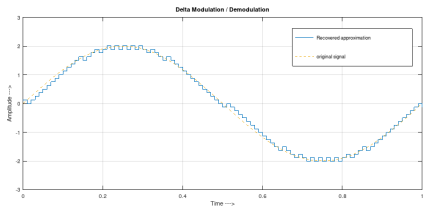
Code

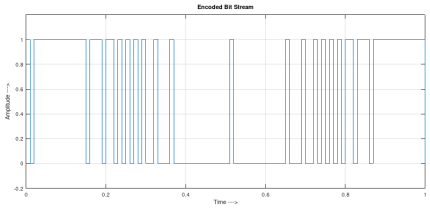
```
% octave pkg to load signal based utils
pkg load signal
pkg load communications

clc;
clear alll;
close all;

%Inputs
a = 2
t = 0:1/100:1;
x = a*sin(2*pi*t);
l = length(x)
delta = input('Required Step Size: ');

%Variation of this step size results in the
% problems of delta modulation like
%  granular noise and slope overloading
% leading to improper reconstruciton

xn = 0;

for i=1:l
    if x(i) >= xn(i)
        d(i) = 1;
        xn(i+1) = xn(i) + delta;
    else
        d(i) = 0;
        xn(i+1) = xn(i) - delta;
    end
end

% Plotting

subplot(2, 1, 1);
stairs(t, xn(2:end));
grid on;
title('Staircase Approximation');
xlabel('Time --->');
ylabel('Amplitude --->');

subplot(2, 1, 2);
stairs(t, d);
grid on;
title('Encoded Bit Stream');
xlabel('Time --->');
ylabel('Amplitude --->');
ylim([-0.2 1.2])

% Recovery

r = 0;
for i=1:length(d)
    if d(i) == 0
        r(i+1) = r(i) - delta;
    else
        r(i+1) = r(i) + delta;
    end
end

[p, q] = butter(2, 1/20);
rec = filter(p, q, r);

figure
subplot(2, 1, 1);
stairs(t, r(2:end));
hold on;
plot(t, x, '--');
legend('Recovered approximation', 'original signal');
grid on;
title('Delta Modulation / Demodulation');
xlabel('Time --->');
ylabel('Amplitude --->');

subplot(2, 1, 2);
plot(t, rec(2:end));
grid on;
title('Recovered Analog Waveform');
xlabel('Time --->');
ylabel('Amplitude --->');

pause
```

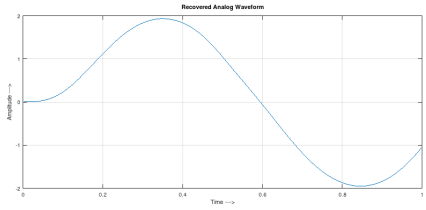
Outputs:

Case 1: Adequate Step Size $\delta = \pi/25$

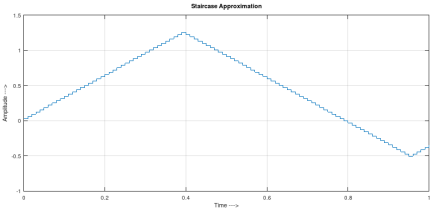


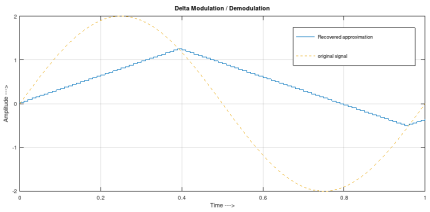


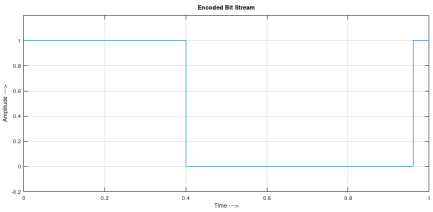


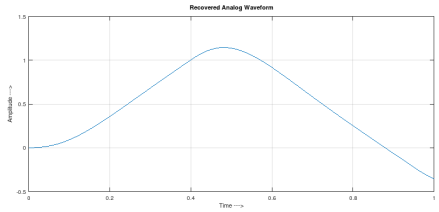


Case 2: Large Step Size $\delta = \pi/100$









Case 3: Small Step Size $\delta = \pi/10$