सरदार वल्लभभाई राष्ट्रीय प्रौद्योगिकी संस्थान, सुरत

Sardar Vallabhbhai National Institute of Technology, Surat

Year 2020-21

Digital Communication
E-Laboratory and practicals
B.Tech. II (CSE), semester –III

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Experiment - 10

Objective:

To demonstrate the delta modulation (DM) and demodulation technique. Show the sampled, quantized/ encoded and decoded time domain signal.

Show the input/output waveforms using Matlab code/Si mulink in virtual mode.

Delta Modulation

- Delta modulation is a technique used to convert analog-to-digital and digital-to-analog signal.
- In this modulation, signal is sent in differential form, the data is encrypted/transmitted in 1 bit.
- The analog signal is approximated with series of segments and each segment is compared to original analog to determine the change in relative amplitude.
- Hence only change in information is sent and if no change occurs it remains on the same state.
- This is the simplified form of Differential Pulse code Modulation and also called as ***1-bit(2-level)*** version of DPCM.
- It provides a staircase approximation of over-sampled base-band signal. Here, the difference between the present sample and previous approximated sample is quantized into two levels i.e. ± **Δ** (delta).
- This is used for voice transmission.

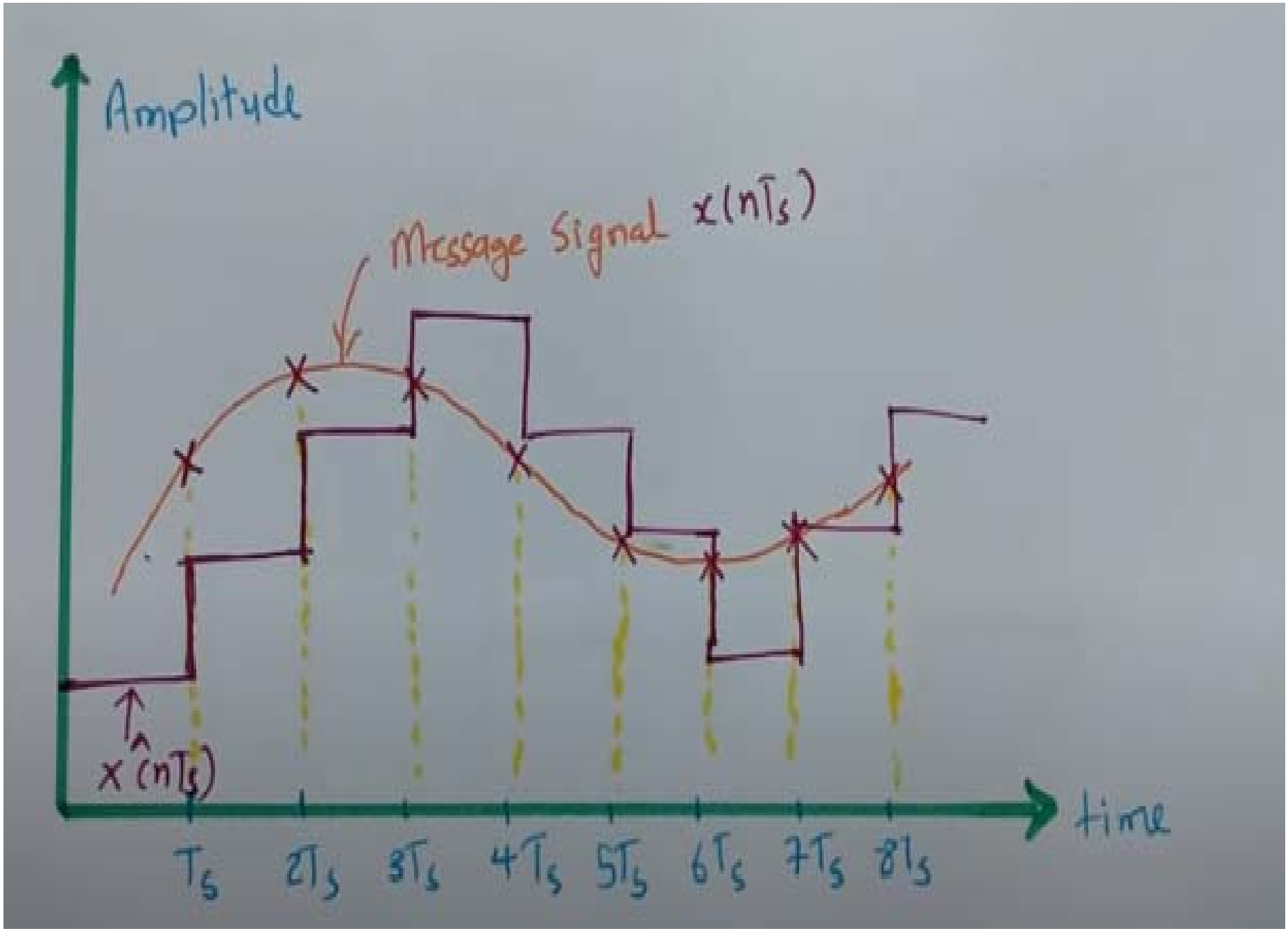
Operating Principle :

The operating principle of DM is such that, a comparison between present and previously sampled value is performed, the difference of which decides the increment or decrement in the transmitted values.

when the two sample values are compared, either we get difference having a positive polarity or negative polarity.

If the difference polarity is positive, then the step of the signal denoted by Δ is increased by 1. As against in case when difference polarity is negative then step of the signal is decreased i.e., reduction in Δ.

When **$+\Delta$ is noticed i.e., increase in step size, then 1 is transmitted**. However, in the case of **$-\Delta$ i.e., decrease in step size, 0 is transmitted**


Amplitude
Message Signal x(nTs)
x̂(nTs)
time
Ts
2Ts
3Ts
4Ts
5Ts
6Ts
7Ts
8Ts

Generation and detection of DM Signal :

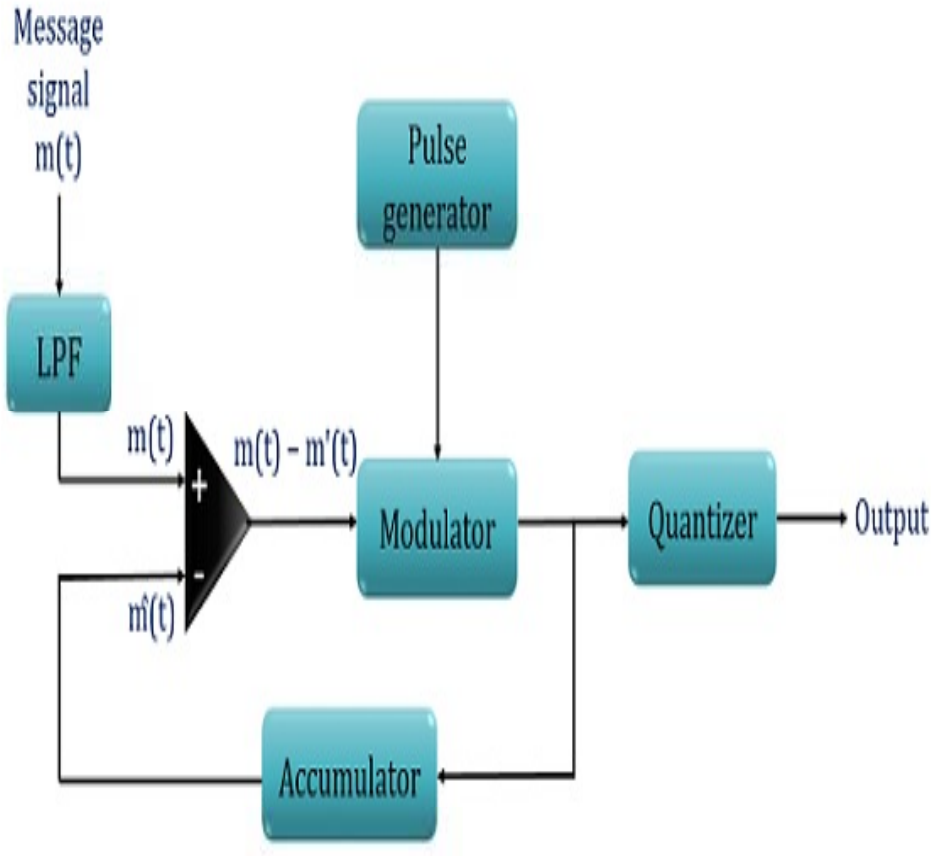


fig- DM transmitter

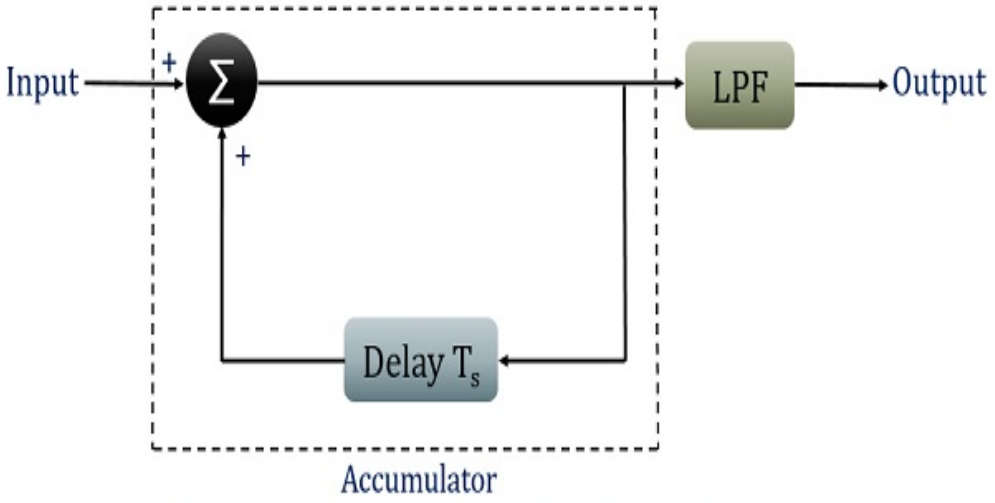
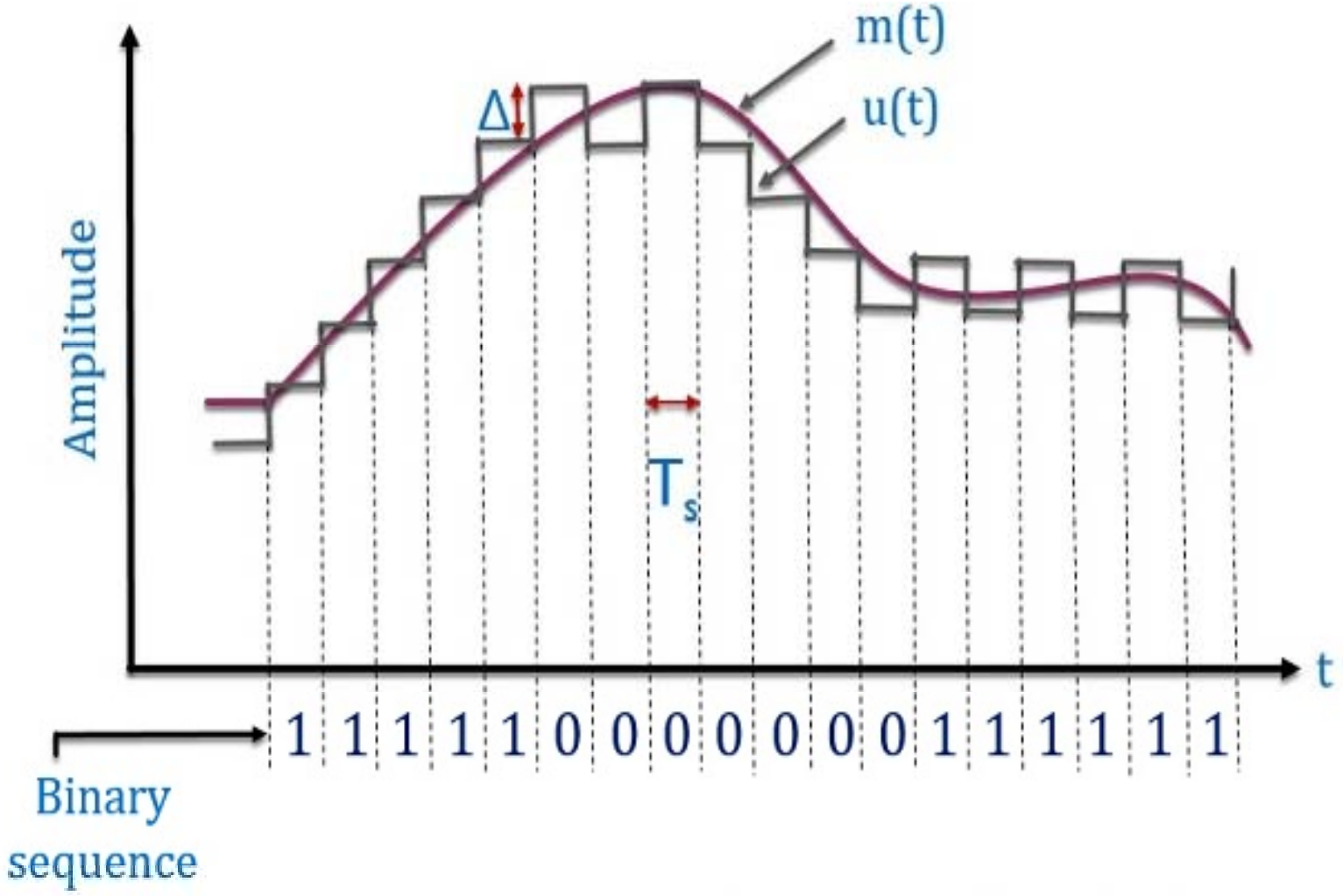


fig-DM reciever

Waveform representation of Delta Modulated Signal:



Advantages of delta modulation

Due to transmission of 1 bit per sample, it permits low channel bandwidth as well as signaling rate.
ADC is not required. Thus permits easy generation and detection.

Disadvantages of delta modulation

Delta modulation leads to drawbacks such as slope overload distortion(when Δ is small) and granular noise(when Δ is large).

Applications of delta modulation

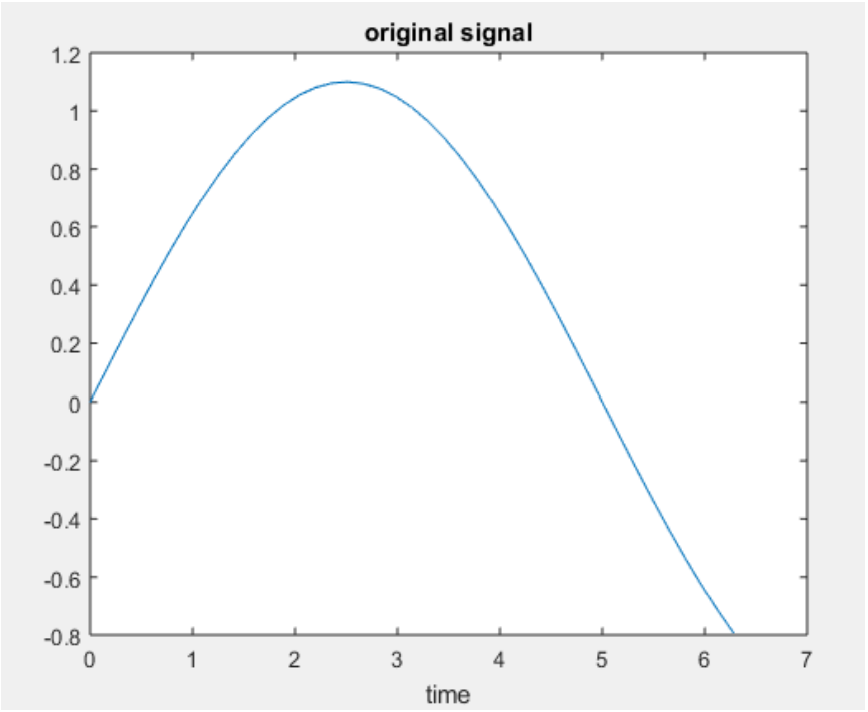
It is widely used in radio communication devices and digital voice storage and voice transmission.

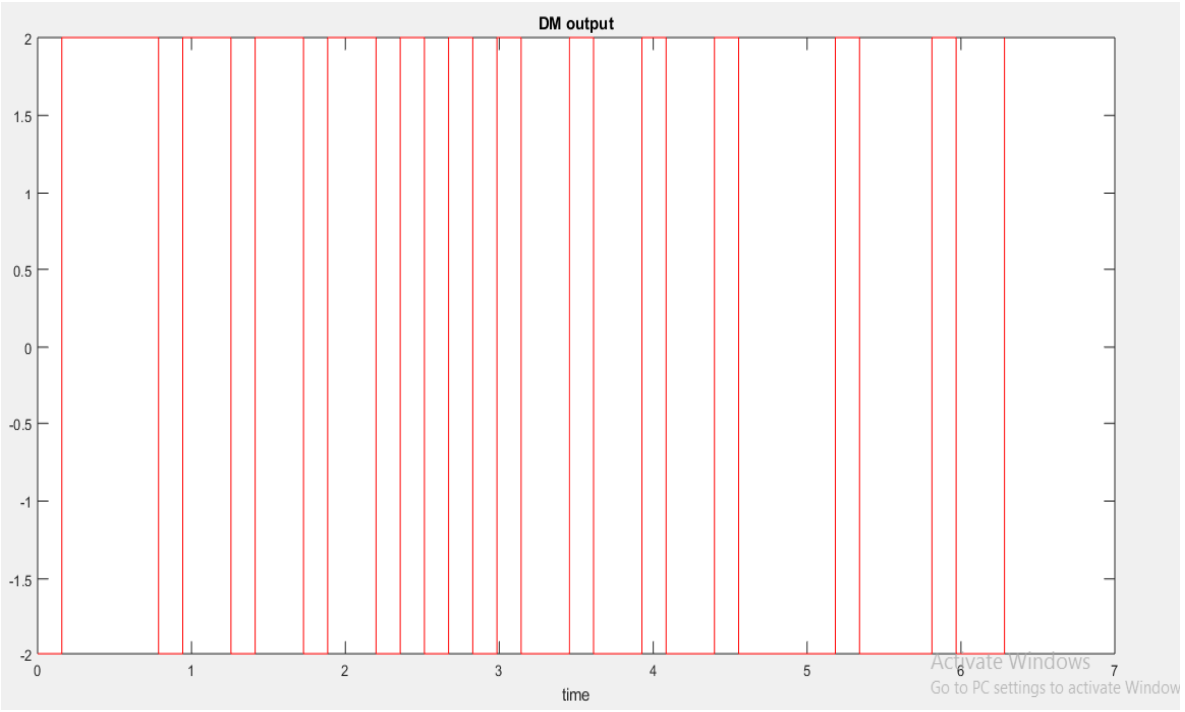
Matlab code:

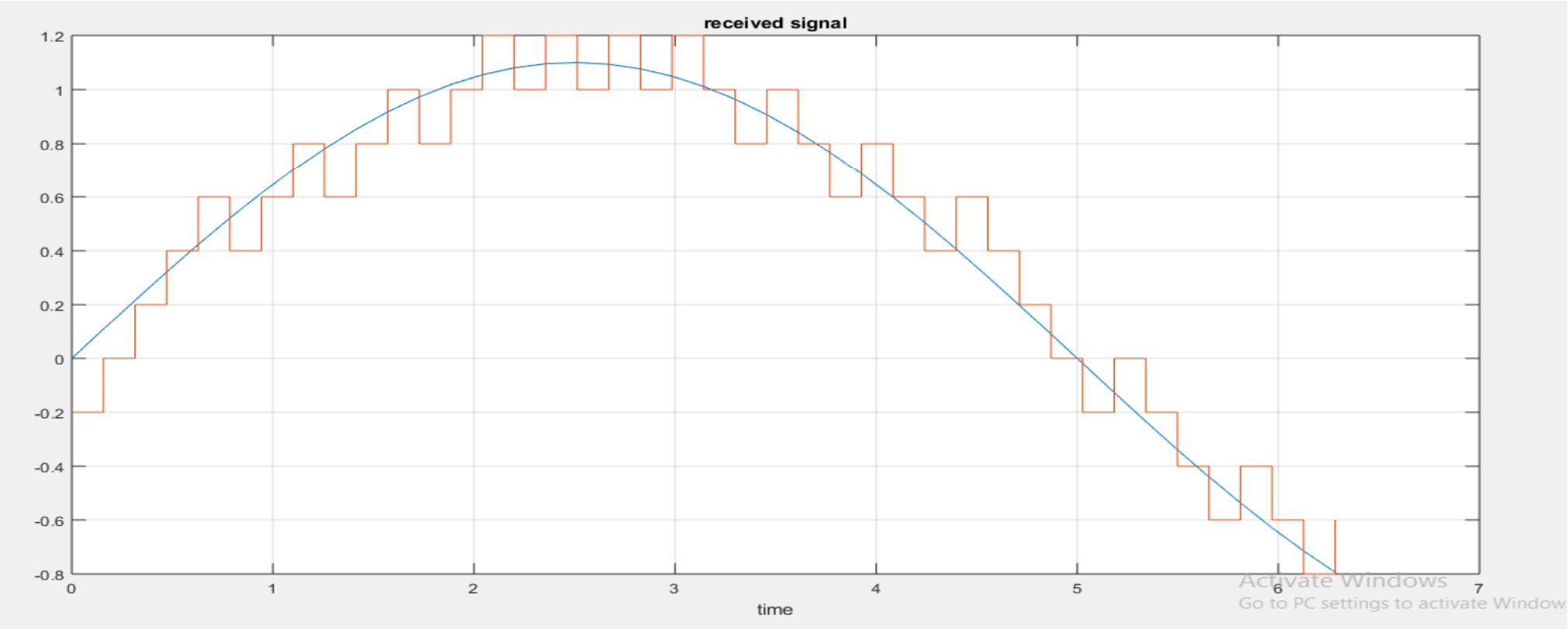
```
%% Delta Modulation (DM)
predictor = [0 1];
partition = [-1:.1:.9];
step=0.2;
partition = [0];
codebook = [-1*step step];
%DM quantizer
t = [0:pi/20:2*pi];
x = 1.1*sin(2*pi*0.1*t); % Analog Signal

% Quantize x(t) using DPCM.
encoded_x=dpcmenco(x,codebook,partition,predictor);
% Try to recover x from the modulated signal.
decoded_x=dpcmdeco(encoded_x,codebook,predictor);

% plots
figure
plot(t,x);
xlabel('time');
title('original signal');
figure
stairs(t,10*codebook(encodedx+1),'g');
xlabel('time');
title('DM output');
figure
plot(t,x);
hold;
stairs(t,decodedx);
grid;
xlabel('time');
title('received signal');
```


original signal
time


DM output
time
Activate Windows
Go to PC settings to activate Window


received signal
time
Activate Windows
Go to PC settings to activate Window

THANK
YOU