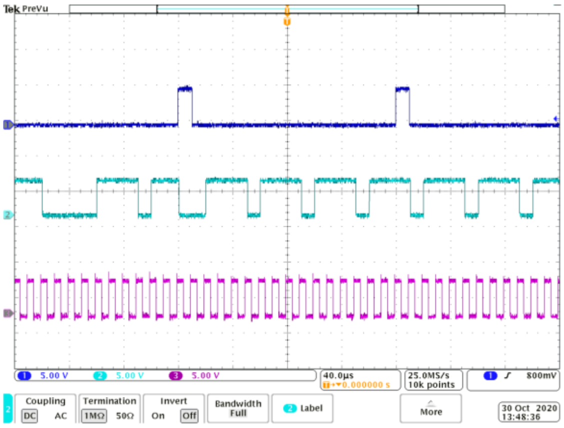
C6 Sharmin Islam 31501842

Communications and Signal Processing

3 Pulse Code Modulation

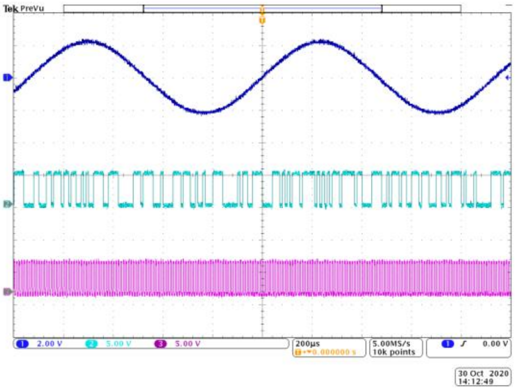
3.2 Setting up the PCM encoder



MDO4054B-3 - 15:00:53 30/10/2020

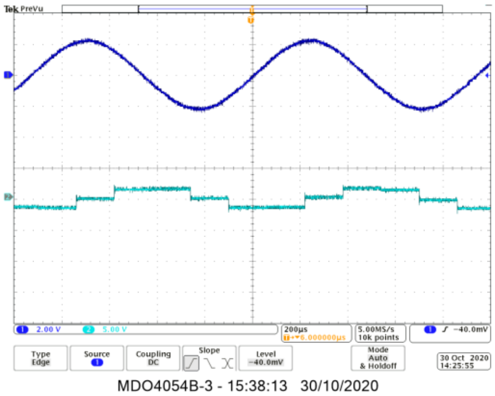
1. Binary number the pcm encoder module is outputting:
   01110111
2. The difference between a sampled voltage and its closest quantisation level:
   Quantisation error
3. The difference between the quantisation levels:
   4/256= 15.625mV
4. Maximum quantisation noise:
   4/(256*2)
5. Reduce quantisation error by having more quantisation levels and the number of quantisation levels can be changed by having more data.

3.3 Decoding the PCM data



MDO4054B-3 - 15:25:06 30/10/2020

6. The PCM decoder’s ‘stepped’ output tells us this signal is a sinewave and speech signal.



200µs
T→▾6.000000µs
5.00MS/s
10k points
Type Edge
Source 1
Coupling DC
Slope
Level −40.0mV
Mode Auto & Holdoff
30 Oct 2020
14:25:55

MDO4054B-3 - 15:38:13 30/10/2020

7. In order to reconstruct the message appropriately, the PCM decoder modules output needs to be put through a low pass filter.

3.4 Encoding and decoding speech

3.5 Recovering the message

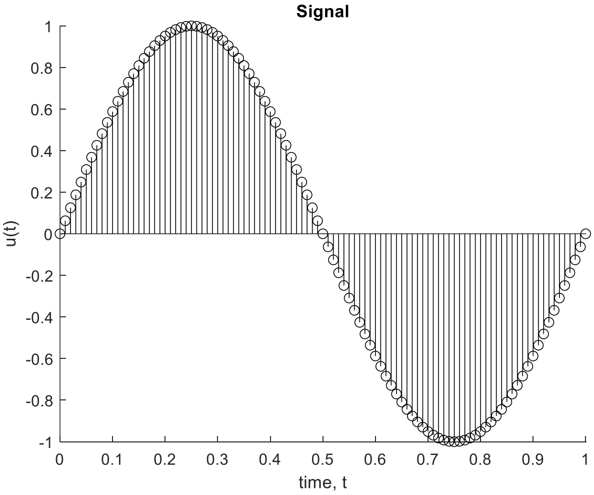
8. The reconstructed message isn’t a perfect copy of the original message as there is a slight phase shift. As the amplitude of the message signal changes, the phase (shift) changes.
   Quantisation error is the main reason (there is a difference between the sampled voltage and the closest quantisation level)

4 Sinusoidal Sequences

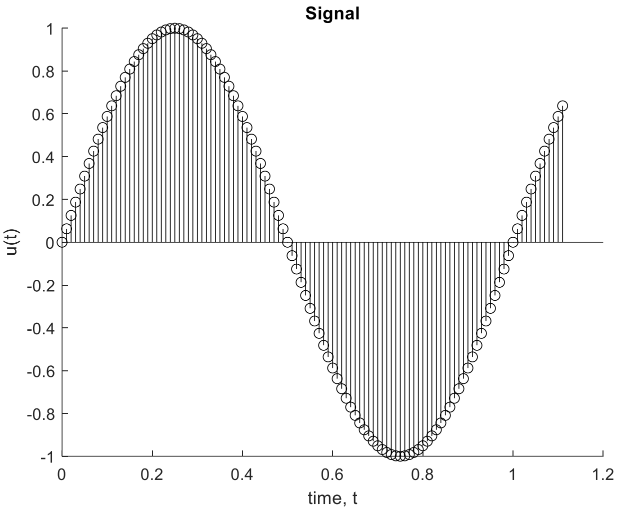
4.1 Questions

1.

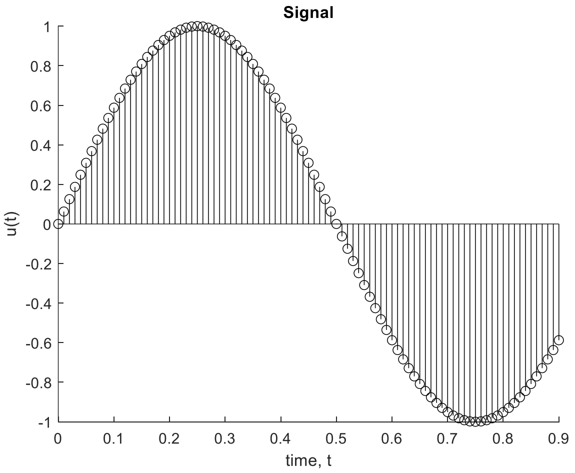
   a. The code will plot a sine graph of u(t) against t. t will go up in intervals of 0.01, going up to T=1.



b. F= 1/T, so I edited the code to make T=1/0.9 (as F=0.9 is what’s required)

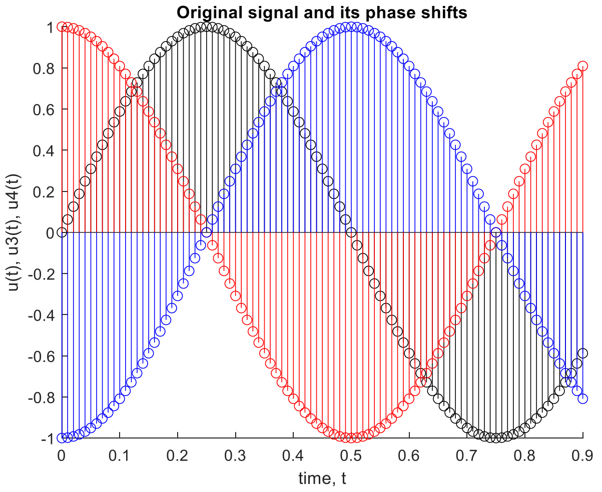


c. F=1/T, F=1.1 therefore T=1/1.1

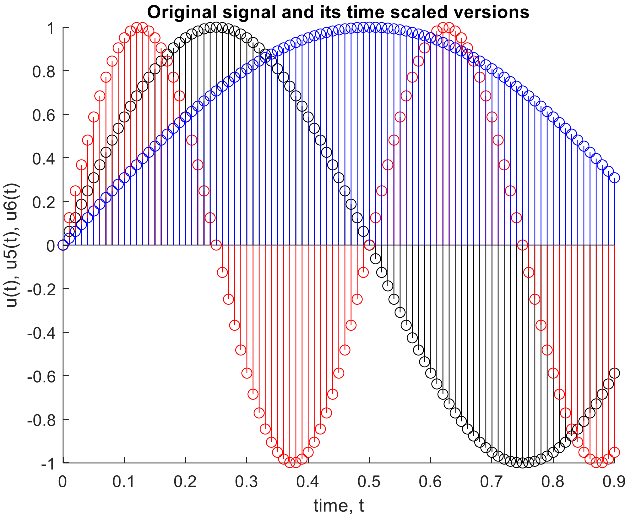


2. Time and phase shift

Plots multiple equations on the same graph



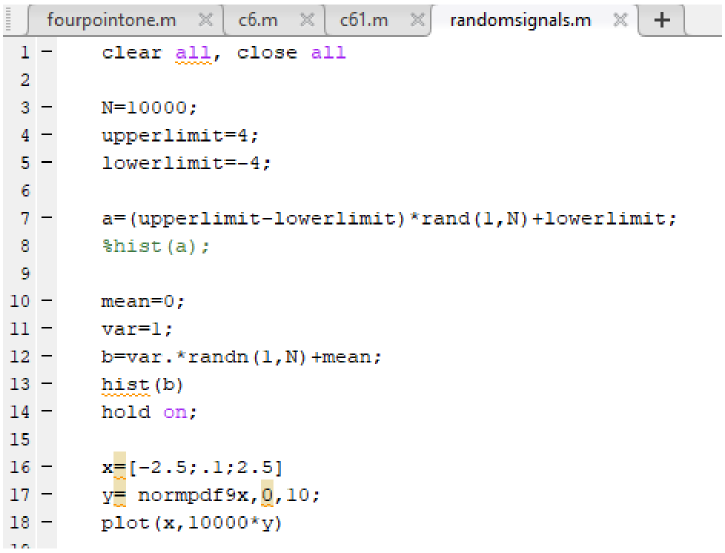
3. Time Scaling



5 Random Signals

5.1 Questions

1,2, and 3:



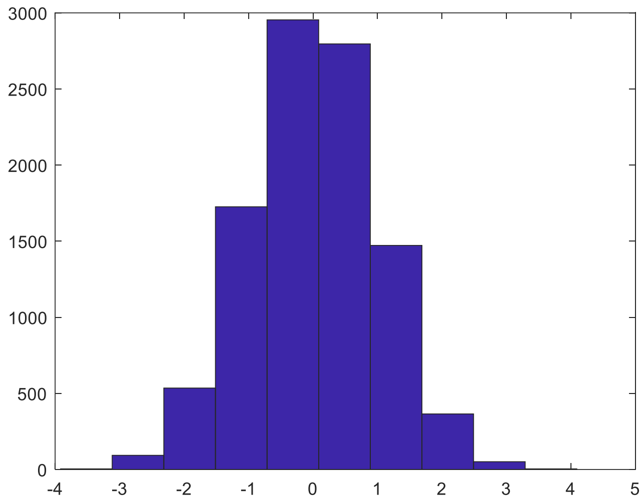
```
clear all, close all

N=10000;
upperlimit=4;
lowerlimit=-4;

a=(upperlimit-lowerlimit)*rand(1,N)+lowerlimit;
%hist(a);

mean=0;
var=1;
b=var.*randn(1,N)+mean;
hist(b)
hold on;

x=[-2.5;.1;2.5]
y= normpdf9x,0,10;
plot(x,10000*y)
```


3000
2500
2000
1500
1000
500
0
-4
-3
-2
-1
0
1
2
3
4
5