Experiment No: 2 Date:8/08/2024

VERIFIACTION OF SAMPLING THEOREM

Aim

To perform and verify undersampling, nyquist sampling and oversampling**.**

Theory

The sampling theorem, also known as the Nyquist-Shannon theorem, states that a continuous-time signal can be completely reconstructed from its samples if it is sampled at a rate greater than twice its highest frequency component, known as the Nyquist rate. Mathematically, if the maximum frequency of the signal is fmax,the sampling frequency fs must satisfy $fs \geq 2fmax$ to avoid loss of information and prevent aliasing.

Applications of the Sampling Theorem:

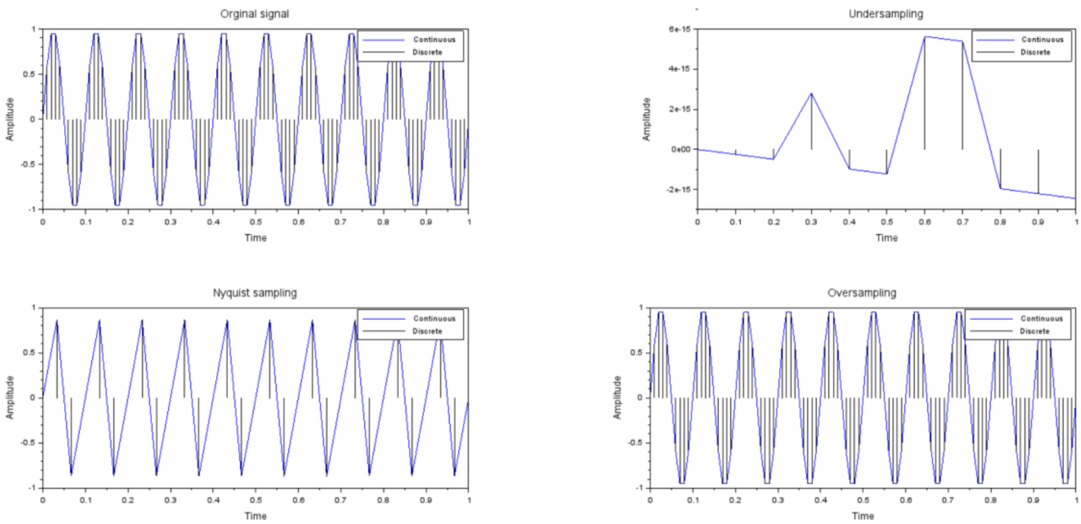
1. Digital audio processing (e.g., CDs, MP3s)
2. Digital communication systems
3. Medical imaging (e.g., MRI, CT scans)
4. Video compression (e.g., MPEG, HDTV)
5. Radar and sonar systems

Program

```
//verification of sampling theorem

clc;

clear ;

close;

clf;

//original signal

t=0:0.01:1;

fm=10;
```

```
y=sin(2*%pi*fm*t);
subplot(2,2,1);
plot(t,y);
plot2d3(t,y);
xlabel("Time");
ylabel("Amplitude");
title("Orginal signal");
legend("Continuous","Discrete");
//less than nyquist rate
fs1=fm;
t1=0:1/fs1:1;
y1=sin(2*%pi*fm*t1);
subplot(2,2,2);
plot(t1,y1);
plot2d3(t1,y1);
xlabel("Time");
ylabel("Amplitude");
title("Undersampling");
legend("Continuous","Discrete");
//equal to nyquist rate
fs2=3*fm;
t2=0:1/fs2:1;
y2=sin(2*%pi*fm*t2);
subplot(2,2,3);
plot(t2,y2);
plot2d3(t2,y2);
xlabel("Time");
ylabel("Amplitude");
title("Nyquist sampling");
```

OUTPUT



Orginal signal
Undersampling
Nyquist sampling
Oversampling
Amplitude
Time
Continuous
Discrete

```
legend("Continuous","Discrete");
//greater than nyquist rate
fs3=10*fm;
t3=0:1/fs3:1;
y3=sin(2*%pi*fm*t3);
subplot(2,2,4);
plot(t3,y3);
plot2d3(t3,y3);
xlabel("Time");
ylabel("Amplitude");
title("Oversampling");
legend("Continuous","Discrete");
```

Result

Performed and verified undersampling, nyquist sampling and oversampling**.**