

# Indian Institute of Information Technology, Allahabad

## Department of Electronics and Communication Engineering

Course Name: Analog Communication

EXPERIMENT NO: 5

To study Amplitude and phase distortions using MATLAB

**Objective** – Design two low pass filters with transfer function  $H_1(s)=1/s+1$ , i.e. linear phase and  $H_2(s)=1/s^2+s+1$ , i.e. non-linear phase. Find the response of the given signal  $x(t)=0.5*\cos(2*\pi*10*t)$  for two filters. Draw the amplitude, phase spectra of the filters, and compare them. Also, comment to the obtained results.

**Materials Required** - MATLAB Software.

**Program** –

```
%To study Amplitude and phase distortions using MATLAB
clc;
clear all;
close all;
t=0:0.001:10; % time scale
k=0:1:10000; % samples of fft
x=0.5*cos(2*pi*10*t); % input with some phase & frquency
h(t>=0)=exp(-t); % impulse response of linear filter
h1(t>=0)=(2/1.732)*exp(-0.5*t).*sin(1.732*0.5*t); % impulse response of non-linear filter
H=fft(h); % 10001 samples of fourier transform of linear filter
H1=fft(h1); % 10001 samples of fourier transform of non linear filter
X=fft(x); % fourier transform of input
Y=H.*X; % frequency response of linear filter
Y1=H1.*X; % frequency response of non linear filter
y=ifft(Y); % time domain response of linear filter
y1=ifft(Y1); % time domain response of non linear filter
subplot(3,2,1)
plot(t,x)
xlabel('time(sec)');
ylabel('x(t)');
legend('Input Signal')
subplot(3,2,2)
plot(t,0.001*y)
xlabel('time(sec)');
ylabel('y(t)');
legend('Filtered Response Linear Filter')
title('Linear Filter')
subplot(3,2,3)
plot(t,0.001*y1)
xlabel('time(sec)');
ylabel('y(t)');
legend('Filtered Response Non-Linear Filter')
title('Non-Linear Filter')
subplot(3,2,4)
plot(k,0.001*abs(H),k,0.001*abs(H1))
xlabel('frequency(Hz)');
ylabel('Magnitue Response');
legend('Linear Filter','Non-Linear Filter')
title('Magnitue Response')
subplot(3,2,5)
```

```
plot(k, angle(H), k, angle(H1))
xlabel('frequency(Hz)');
ylabel('Phase Response');
legend('Linear Filter', 'Non-Linear Filter')
title('Phase Response')
```

## Results -

