Rajshahi University of Engineering & Technology

Department : Electrical & Computer Engineering

Course No: ECE 4124

Course Name: Digital Signal Processing Sessional

Submitted By:

Sumaiya Tabassum
Roll: 1810023

Submitted To:

Hafsa Binte Kibria
Lecturer,Dept of ECE

Experiment No: 5
Experiment Date: 22.5.23
Experiment Name: Study about causal,anti causal & non causal signal.

Theory:

Causal Signal:

A continuous time signal $x(t)$ is called causal signal if the signal $x(t) = 0$ for $t < 0$. Therefore, a causal signal does not exist for negative time. The unit step signal u(t) is an example of causal signal .Similarly, a discrete time sequence x(n) is called the causal sequence if the sequence x(n) = 0 for n < 0.

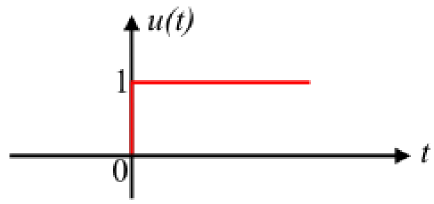


Figure-1

Anti-Causal Signal:

A continuous-time signal x(t) is called the anti-causal signal if x(t) = 0 for t > 0. Hence, an anti-causal signal does not exist for positive time. The time reversed unit step signal u(-t) is an example of anti-causal signal .Similarly, a discrete time sequence x(n) is said to be anti-causal sequence if the sequence x(n) = 0 for $t > 0$.

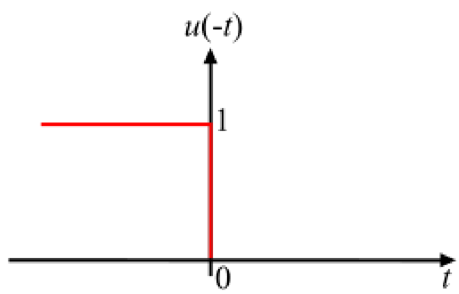


Figure-2

Non-Causal Signal:

A signal which is not causal is called the non-causal signal. Hence, by the definition, a signal that exists for positive as well as negative time is neither causal nor anti-causal, it is non-causal signal. The sine and cosine signals are examples of non-causal signal (see Figure-3).

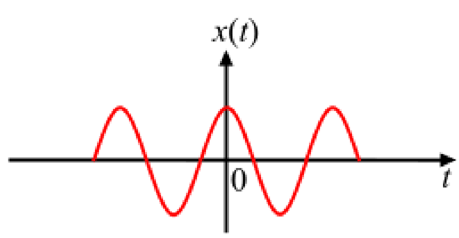


Figure-3

Zeroes & Poles:

The values of z for which H(z) = 0 are called the zeros of H(z), and the values of z for which H(z) is infinite are referred to as the poles of H(z).

Code & Output:

Causal Signal:

Code:

```
clc;
clear all;
close all;
x=[3 1 4 2 5];
l=length(x);
A=0;
z=sym('z');
for i=0:l-1
    A=A+x(i+1).*z^(-i);
end
disp('Causal Output:');
disp(A);
```

Output:

Causal Output:
1/z + 4/z^2 + 2/z^3 + 5/z^4 + 3

Anti Causal Signal:

Code:

```
clc;
clear all;
close all;
y=[3 1 4 2 5];
x=fliplr(y);
l=length(x);
A=0;
z=sym('z');
for i=0:l-1
    A=A+x(i+1).*z^(i);
end
disp('AntiCausal Output:');
disp(A);
```

Output :

```
AntiCausal Output:
3*z^4 + z^3 + 4*z^2 + 2*z + 5
```

Non Causal Signal:
Code:

```
clc;
clear all;
close all;

x = [3 1 4 2 5];
n=length(x);
k=input('Enter zero index:');
p=[];
for i=0:k-1
    p(i+1)=x(i+1);
end

h=fliplr(p);
a=length(h);

A=0;
z=sym('z');
for i=0:a-1
    A=A+h(i+1).*z^(i);
end

q=[];
for i=1:(n-k)
    q(i)=x(i+k);
end

b=length(q);
for i=0:b-1
    A=A+q(i+1).*z^(-(i+1));
end
disp(A);
```

Output:
Enter zero index:3
z + 2/z + 5/z^2 + 3*z^2 + 4

Inverse Z transform & plotting zeroes and poles of the discrete signal x=[3 1 4 2 5]:
Code:

```
clc;
clear all;
close all;
x=[3 1 4 2 5];
l=length(x);
A=0;
z=sym('z');
for i=0:l-1
    A=A+x(i+1).*z^(-i);
end
disp('Causal Output:');
disp(A);
f=iztrans(A);
disp(f);
z=[];
p=[0];
zplane(z,p);
grid;
```

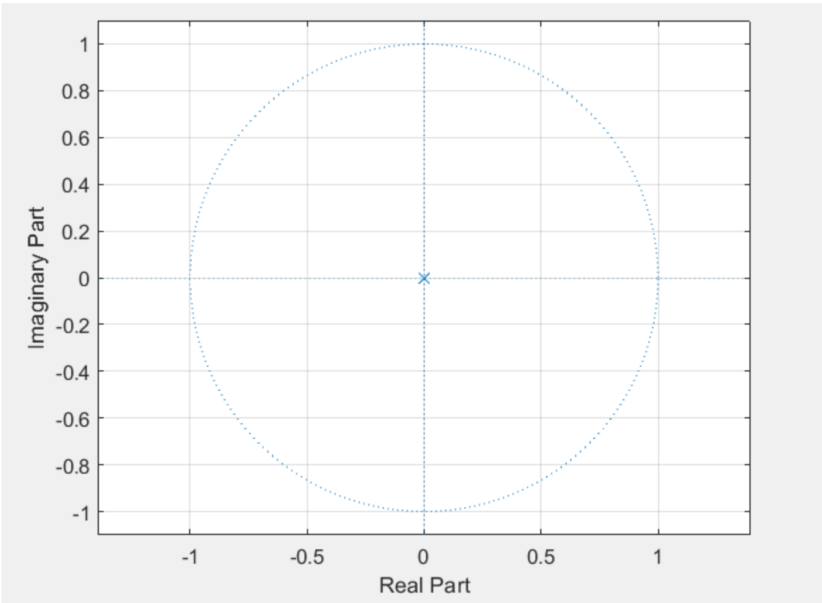
Output:

Causal Output:

1/z + 4/z^2 + 2/z^3 + 5/z^4 + 3

kroneckerDelta(n - 1, 0) + 4*kroneckerDelta(n - 2, 0) + 2*kroneckerDelta(n - 3, 0) + 5*kroneckerDelta(n - 4, 0) + 3*kroneckerDelta(n, 0)

Plotting Zeroes and Poles :



Conclusion:

Here the same discrete signal has been used for getting causal ,anti causal and non causal signal.The output signal gained for causal one was x(t)=0 for t<0 & x(t)=0 for t>0.Then the inverse transform and the plotting of poles and zeroes were also gained successfully.