

Rajshahi University of Engineering & Technology



Department : Electrical & Computer Engineering

Course No: ECE 4124

Course Name: Digital Signal Processing Sessional

Submitted By:

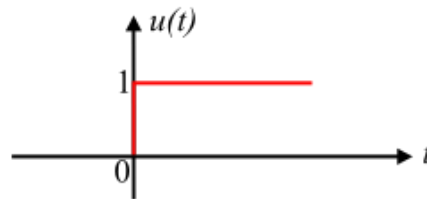
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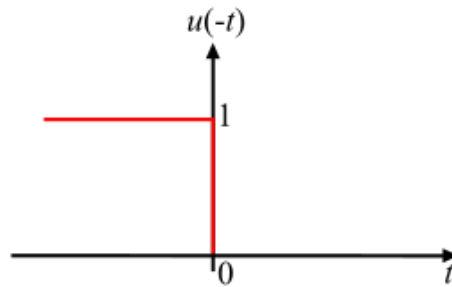
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Experiment No: 4**Experiment Date: 22.5.23****Experiment Name: Study about causal, anti causal & non causal signal.****Theory:****Causal Signal:**

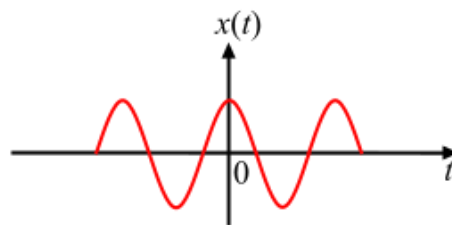
A continuous time signal $x(t)$ is called causal signal if the signal $x(t) = 0$ for $t < 0$. Therefore, a causal signal does not exist for negative time. The unit step signal $u(t)$ is an example of causal signal. Similarly, a discrete time sequence $x(n)$ is called the causal sequence if the sequence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

$$3z^4 + z^3 + 4z^2 + 2z + 5$$

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

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

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=[];
zplane(z,p);
grid;
```

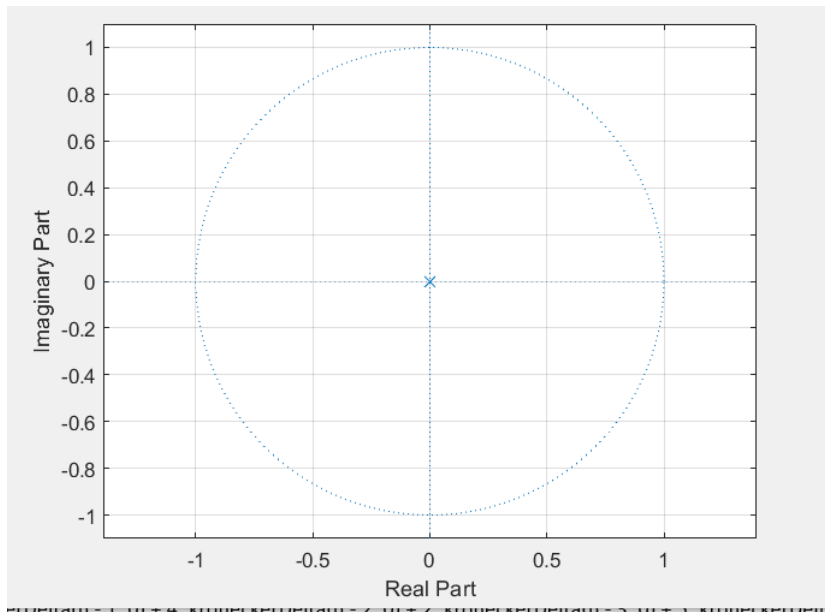
Output:

Causal Output:

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

$\text{kroneckerDelta}(n - 1, 0) + 4*\text{kroneckerDelta}(n - 2, 0) + 2*\text{kroneckerDelta}(n - 3, 0) + 5*\text{kroneckerDelta}(n - 4, 0) + 3*\text{kroneckerDelta}(n, 0)$

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.