Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology

Department of Electrical & Computer Engineering

Lab Reports

Course Title : Digital Signal Processing Sessional

Course No: ECE 4124

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Experiment Name: Experiment on finding the Z-transform and inverse Z-transform of a function.

Theory:
An analytical and processing tool for discrete-time signals and systems in the frequency domain is the Z-transform in digital signal processing. In continuous-time signal processing, it is comparable to the Laplace transform. With the Z-transform, discrete-time signals and systems can be represented in terms of a complex variable, "z," enabling investigation of their frequency content and behaviour.

Software used: MATLAB

Code:

Z-transform and inverse Z-transform for right-side signal:

```
clc;
close all;
clear all;
syms n;

x = [1 2 3 4 5];
l = length(x);
trans = 0;
z = sym('z');
for i=0:l-1
    trans=trans+x(i+1).*z^(-i);
end
disp('Z-transform for the right sided signal:');
disp(trans);
f=iztrans(trans);
disp('Inverse Z-transform for the right sided signal:');
disp(f);
```

Z-transform and inverse Z-transform for left-side signal:

```
clc;
close all;
clear all;
syms n;
x = [1 2 3 4 5];
y = fliplr(x);
l = length(y);
trans = 0;
z = sym('z');
for i=0:l-1
    trans=trans+y(i+1).*z^(i);
end
disp('Z-transform for the left sided signal:');
disp(trans);
f=iztrans(trans);
disp('Inverse Z-transform for the left sided signal:');
disp(f);
```

Z-transform and inverse Z-transform for non-causal signal:

```
clc;
close all;
clear all;
syms n;
x = [1 2 3 4 5 6 7];
n = length(x);
k=input('Enter zero index:');
p=[];
for i=0:k
    p(i+1)=x(i+1);
end
h=fliplr(p);
u=length(h);
trans = 0;
z = sym('z');
for i=0:u-1
    trans=trans+h(i+1).*z^(i);
end
q=[];
for i=0:(n-k-2)
    q(i+1)= x(i+k+2);
end

v=length(q);
for i=0:v-1
    trans=trans+q(i+1).*z^(-(i+1));
end
disp('Z-transform for non-causal signal:');
disp(trans);
f=iztrans(trans);
disp('Inverse Z-transform for non-causal signal:');
disp(f);
```

Output:

Z-transform and inverse Z-transform of right-sided signal:

```
Z-transform for the right sided signal:
2/z + 3/z^2 + 4/z^3 + 5/z^4 + 1

Inverse Z-transform for the right sided signal:
2*kroneckerDelta(n - 1, 0) + 3*kroneckerDelta(n - 2, 0) + 4*kroneckerDelta(n - 3, 0) +
5*kroneckerDelta(n - 4, 0) + kroneckerDelta(n, 0)
```

Z-transform and inverse Z-transform of left-sided signal:

```
Z-transform for the left sided signal:
z^4 + 2*z^3 + 3*z^2 + 4*z + 5

Inverse Z-transform for the left sided signal:
5*kroneckerDelta(n, 0) + 3*iztrans(z^2, z, n) + 2*iztrans(z^3, z, n) + iztrans(z^4, z, n) +
4*iztrans(z, z, n)
```

Z-transform and inverse Z-transform of non-causal signal:

```
Enter zero index:2
Z-transform for non-causal signal:
2*z + 4/z + 5/z^2 + z^2 + 6/z^3 + 7/z^4 + 3

Inverse Z-transform for non-causal signal:
4*kroneckerDelta(n - 1, 0) + 5*kroneckerDelta(n - 2, 0) + 6*kroneckerDelta(n - 3, 0) + 7*kroneckerDelta(n - 4, 0) + 3*kroneckerDelta(n, 0) + iztrans(z^2, z, n) + 2*iztrans(z, z, n)
```

Discussion:

Right sided, left sided and both sided non causal signal had been analyzed here. The z transform and inverse z transformed had been done and the output was a match to the theoretical knowledge that had been given.

Conclusion:

The experiment had been done perfectly without any error and got the expected output