Marwin B. Alejo 2020-20221 EE274_ProgEx03

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Also accessible through http://www.github.com/soymarwin/ee274/EE274_ProgEx03.

A. The Bilateral Z-Transform

$(a)\quad x(n) = (\frac{4}{3})^n u(1-n)$

Manual Solution

$x(n) = (\frac{4}{3})^n u(-n+1)$

$X(z) = \sum_{n=-\infty}^{\infty} x(n) z^{-n}$

$X(z) = \sum_{n=-\infty}^{\infty} (\frac{4}{3})^n u(-n+1) z^{-n}$

$Let\ k = -n+1\ and\ n = 1-k$

$X(z) = \sum_{n=-\infty}^{\infty} (\frac{4}{3})^{1-k} u(k) z^{k-1}$

$X(z) = \sum_{n=0}^{\infty} (\frac{4}{3}) \cdot ((\frac{4}{3})^{-1})^k \cdot ((1/z)^{-1})^k \cdot z^{-1}$

$X(z) = (\frac{4z^{-1}}{3})\ \sum_{n=0}^{\infty} (\frac{3}{4z^{-1}})^k$

$X(z) = (\frac{4z^{-1}}{3}) \cdot (\frac{1}{1-\frac{3}{4z^{-1}}}),\ 0\ < |\ z\ | <\ \frac{4}{3}$

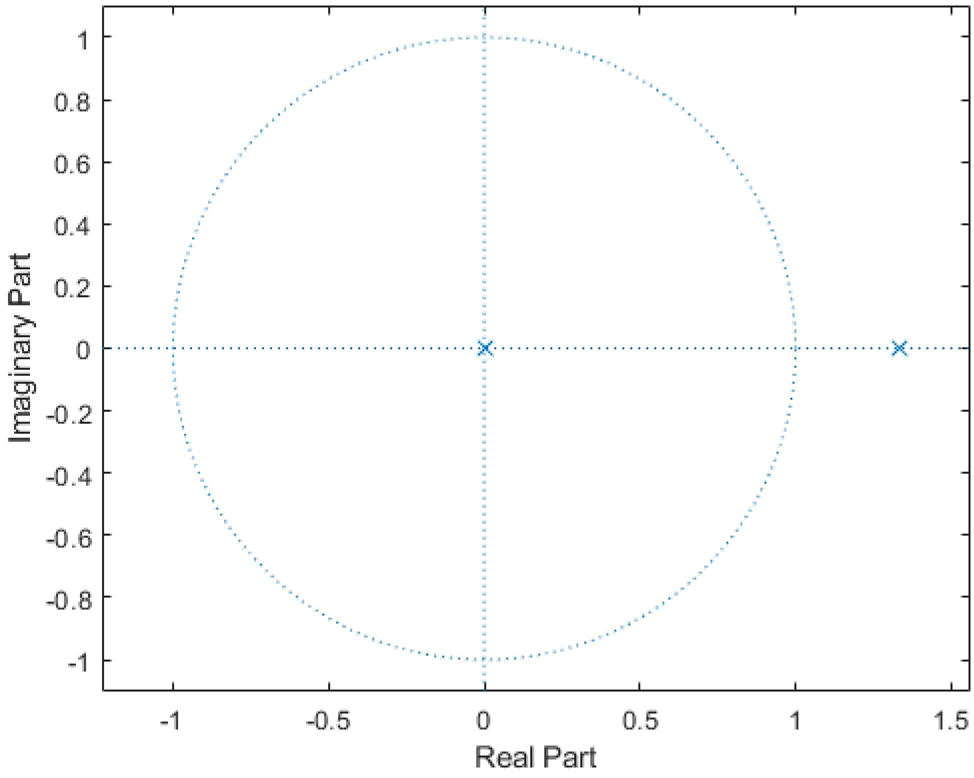
$or\ X(z) = \frac{16z^{-2}}{-9+12z^{-1}},\ 0\ < |\ z\ | <\ \frac{4}{3}$

$or\ X(z) = \frac{-16z^{-2}}{9-12z^{-1}},\ 0\ < |\ z\ | <\ \frac{4}{3}$

z-plane for 1.(a)

```
A1_a_a=[-9, 12, 0];
```

```
A1_a_b=[0, 0, -16];
zplane(A1_a_b,A1_a_a);
```



Verification of z-transform v. original sequence with first 8-coef.

```
[delta,n]= impseq(0,0,7);
A_a_Xz=filter(A1_a_b,A1_a_a,delta) %A_a_Xz is z-transform sequence
A_a_Xn=[(4/3).^n].*stepseq(1,0,7) %A_a_Xn is the original sequence
```

```
A_a_Xz =

  Columns 1 through 7

         0         0    1.7778    2.3704    3.1605    4.2140    5.6187

  Column 8

    7.4915


A_a_Xn =

  Columns 1 through 7

         0         0    1.7778    2.3704    3.1605    4.2140    5.6187
```

Column 8

7.4915

Therefore, based on coef values generated from X(z) and x(n), the z-transform for sequence(a) is correct.

$(b) \quad x(n) = 2^{-|n|} + (\frac{1}{3})^{|n|}$

$X(z) = \sum_{n=0}^{\infty} 2^{-n} z^{-n} + \sum_{n=0}^{\infty} (\frac{1}{3})^n z^{-n}$

$X(z) = \sum_{n=0}^{\infty} (\frac{z^{-1}}{2})^n + \sum_{n=0}^{\infty} (\frac{z^{-1}}{3})^n$

$X(z) = \frac{1}{1-\frac{z^{-1}}{2}} + \frac{1}{1-\frac{z^{-1}}{3}}$

$X(z) = \frac{2}{2-z^{-1}} + \frac{3}{3-z^{-1}}$

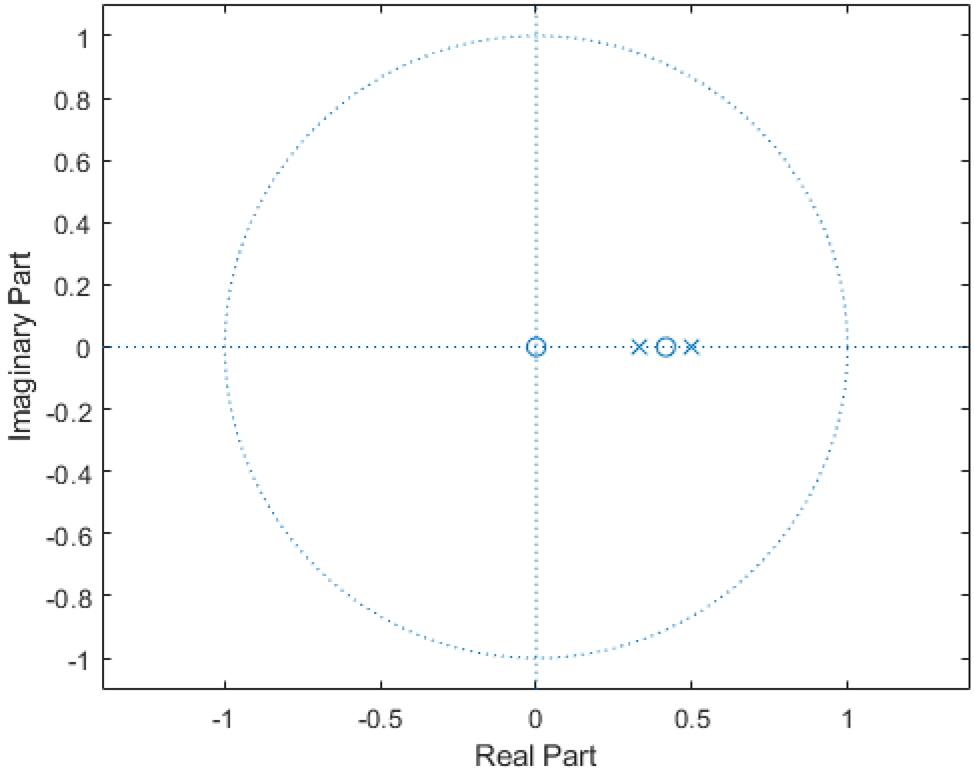
$X(z) = \frac{12-5z^{-1}}{(2-z^{-1})(3-z^{-1})}, \ \frac{1}{3} \ < | \ z \ | < \ \frac{1}{2}$

$or X(z) = \frac{12-5z^{-1}}{6-5z^{-1}+z^{-2}}, \ \frac{1}{3} \ < | \ z \ | < \ \frac{1}{2}$

%

z-plane for 1.(b)

```
A1_b_a=[6 -5 1];
A1_b_b=[12 -5 0];
zplane(A1_b_b,A1_b_a);
```



Verification of z-transform v. original sequence with first 8-coef.

```
[delta,n]= impseq(0,0,7);
A_b_Xz=filter(A1_b_b,A1_b_a,delta) %A_b_Xz is z-transform sequence
A_b_Xn=((2).^(-abs(n)))+((1/3).^(abs(n))) %A_b_Xn is the original
 sequence
```

```
A_b_Xz =

  Columns 1 through 7

    2.0000    0.8333    0.3611    0.1620    0.0748    0.0354    0.0170

  Column 8

    0.0083


A_b_Xn =

  Columns 1 through 7

    2.0000    0.8333    0.3611    0.1620    0.0748    0.0354    0.0170

  Column 8
```

```
0.0083
```

Therefore, based on coef values generated from X(z) and x(n), the z-transform for sequence(b) is correct.

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