
```
%{
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    Fall 2021 - Dr. Sameti
%}
```

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% Part 2: Z-Transform
```

```
syms z n
assume(n, 'integer')
```

1.

```
x1 = [3 2 1 -2 -3];
x2 = (0.8)^n*heaviside(n-2);
x3 = 2^n*cos(0.4*pi*n)*heaviside(n);

subplot(3,1,1)
fplot(x1)
title('x1')
xlabel('n')

subplot(3,1,2)
fplot(x2)
title('x2')
xlabel('n')

subplot(3,1,3)
fplot(x3)
title('x3')
xlabel('n')

X1 = 3*z^2 + 2*z + 1 + (-2)*z^-1 + (-3)*z^-2;
X2 = ztrans(x2);
X3 = ztrans(x3);

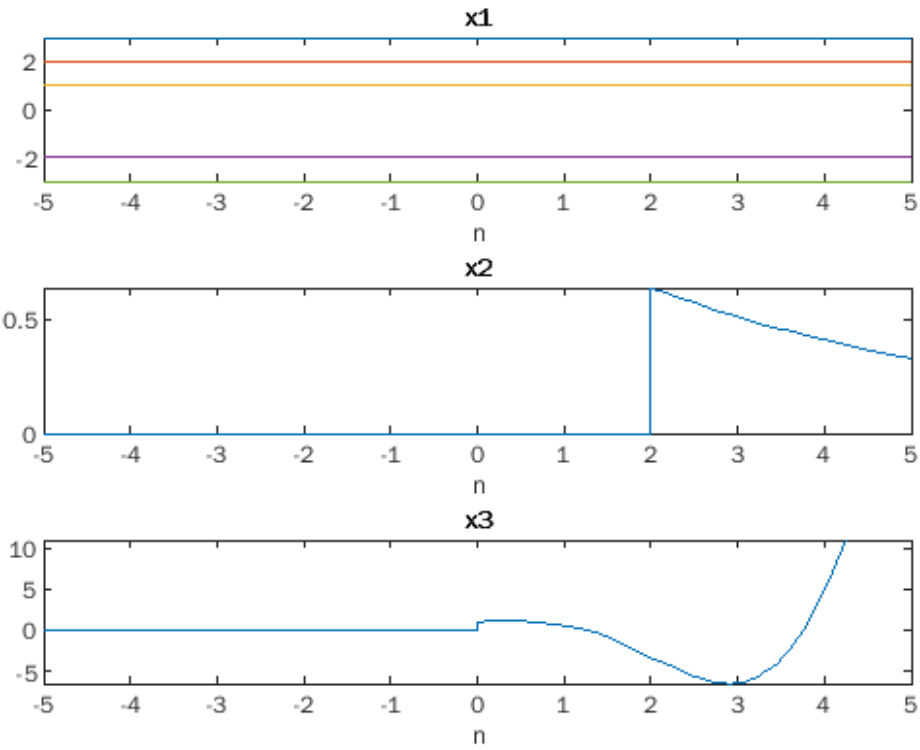
fprintf('X1 = ')
disp(X1)
fprintf('X2 = ')
disp(X2)
fprintf('X3 = ')
disp(X3)

figure
%pzplot(X1)
figure
%pzplot(X2)
figure
%pzplot(X3)

X1 = 2*z - 2/z - 3/z^2 + 3*z^2 + 1
```

$$X2 = (16*(1/((5*z)/4 - 1) + 1/2))/(25*z^2)$$

$$X3 = (2*ztrans(cos((2*pi*(n + 1))/5), n, z/2))/z + 1/2$$



2.

```
H1 = filt([1 -1], [1 -1 0.5]);
figure
pzplot(H1)
H1

H2 = filt([0 1], [2 -sqrt(3) 0.5]);
figure
pzplot(H2)
H2

fprintf('ROC is from the outer pole to infinity\n')
fprintf('Both are unstable since they have poles in the right side\n')

disp(residuez([1 -1], [1 -1 0.5]))
disp(residuez([0 1], [2 -sqrt(3) 0.5]))
```

```

fprintf('h1 = -((-1)^n*2^(1 - n)*(-1 - i)^(n - 1)*i)/2 + ((-1)^n*2^(1 - n)*(i - 1)^(n - 1)*i)/2\n')
fprintf('h2 = (2*(-1)^n*3^(1/2)*cos((5*pi*n)/6))/(3*2^n) + ((-1)^n*3^(1/2)*4^(1 - n)*(-3^(1/2) - i)^(n - 1)*i)/3 - ((-1)^n*3^(1/2)*4^(1 - n)*(-3^(1/2) + i)^(n - 1)*i)/3\n')

```

```

F1 = (1-z^-1)/(1-z^-1+0.5*z^-2);
F2 = (z^-1)/(2-sqrt(3)*z^-1+0.5*z^-2);

```

```

fprintf('h1 = ')
disp(iztrans(F1))
fprintf('h2 = ')
disp(iztrans(F2))

```

H1 =

$$\frac{1 - z^{-1}}{1 - z^{-1} + 0.5 z^{-2}}$$

Sample time: unspecified
Discrete-time transfer function.

H2 =

$$\frac{z^{-1}}{2 - 1.732 z^{-1} + 0.5 z^{-2}}$$

Sample time: unspecified
Discrete-time transfer function.

ROC is from the outer pole to infinity
Both are unstable since they have poles in the right side

0.5000 + 0.5000i
0.5000 - 0.5000i

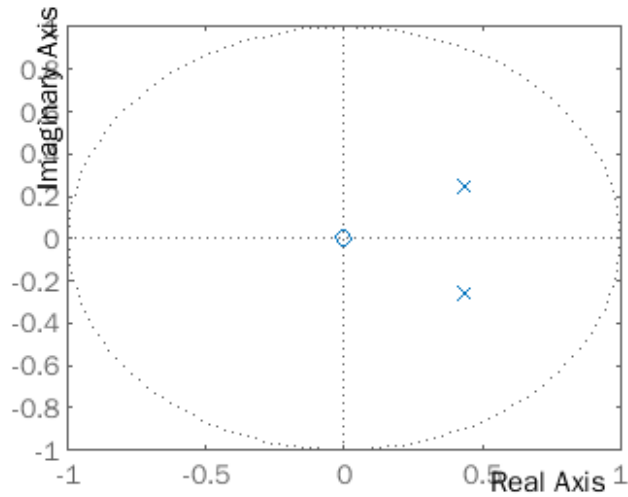
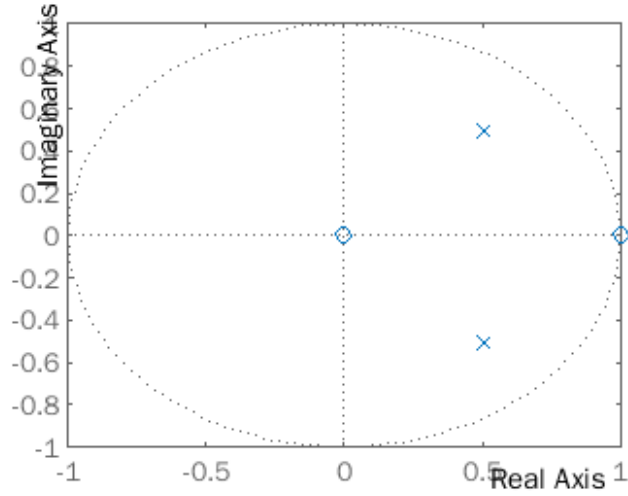
0.0000 - 1.0000i
0.0000 + 1.0000i

```

h1 = -((-1)^n*2^(1 - n)*(-1 - i)^(n - 1)*i)/2 + ((-1)^n*2^(1 - n)*(i - 1)^(n - 1)*i)/2
h2 = (2*(-1)^n*3^(1/2)*cos((5*pi*n)/6))/(3*2^n) + ((-1)^n*3^(1/2)*4^(1 - n)*(-3^(1/2) - i)^(n - 1)*i)/3 - ((-1)^n*3^(1/2)*4^(1 - n)*(-3^(1/2) + i)^(n - 1)*i)/3
h1 = -((-1)^n*2^(1 - n)*(-1 - 1i)^(n - 1)*1i)/2 + ((-1)^n*2^(1 - n)*(-1 + 1i)^(n - 1)*1i)/2

```

$$h_2 = \frac{(2*(-1)^n 3^{1/2} \cos(5\pi n/6))/(3 \cdot 2^n) + ((-1)^n 3^{1/2} 4^{1-n} (-3^{1/2} - 1i)^{(n-1) \cdot 1i})/3 - ((-1)^n 3^{1/2} 4^{1-n} (-3^{1/2} + 1i)^{(n-1) \cdot 1i})/3}{3}$$



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