ELG4177 - DIGITAL SIGNAL PROCESSING
Lab1

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Assignment 01

STEADY STATE, TRANSIENT AND FREQUENCY RESPONSE OF DISCRETE TIME SYSTEMS

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zplane

Example-1: $H(z) = \frac{2+2z^{-1}+z^{-2}}{1-0.8z^{-1}}$

```
b=[2 2 1];
a=[1 -0.8];
zplane(b,a);
```

impz

Example 2: $H(z) = \frac{1}{1-0.9z^{-1}}$ (system with a pole in z=0.9)

```
b=1;
a=[1 -0.9];
[h,t]=impz(b,a);
stem(t,h);
```

freqz

Example 3: $H(z) = \frac{1}{1-0.9z^{-1}}$, i.e. a system with exponentially decaying impulse response

h[n]= $(0.9)^n$ u[n]

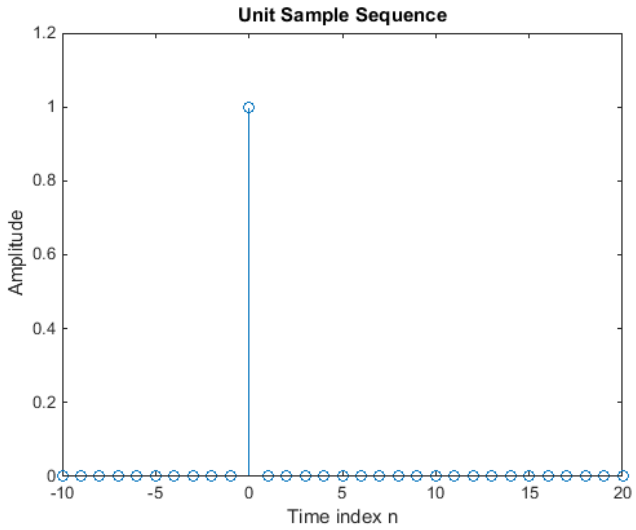
```
b=1;
a=[1 -0.9];
[H,w]=freqz(b,a);
subplot(211)
plot(w/pi, 20*log10(abs(H))); % amplitude plot in decibel
```

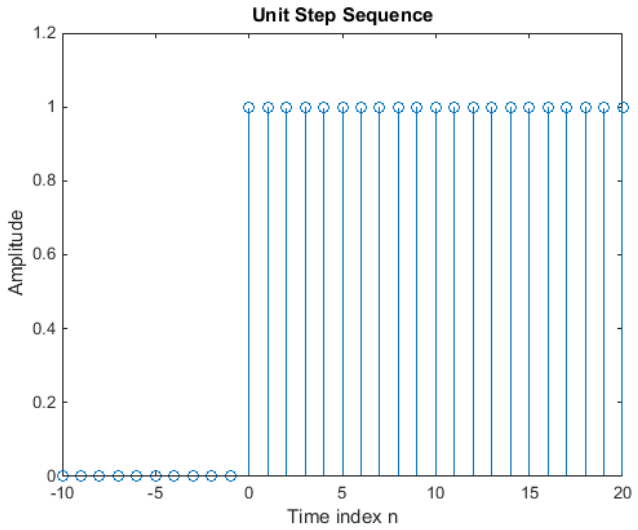
filter

Example 6: $H(z) = \frac{1}{1-0.9z^{-1}}$, (corresponding to h[n]= $(0.9)^n$ u[n])

```
x=[1 zeros(1,100)];   % represents a delta pulse
b=1;
a=[1 -0.9];
y=filter(b,a,x);
stem(y);    % we get the impulse response
```

Unit Sample and Unit Step Sequences





Part (d) prove: (delta[n] = u[n] – u[n-1])

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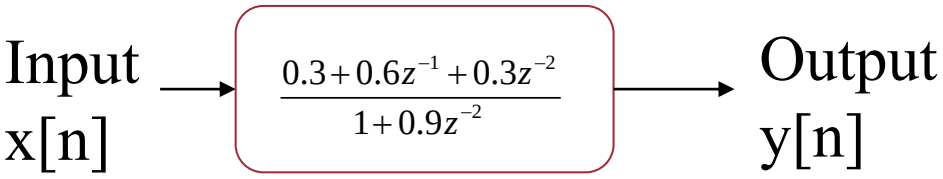
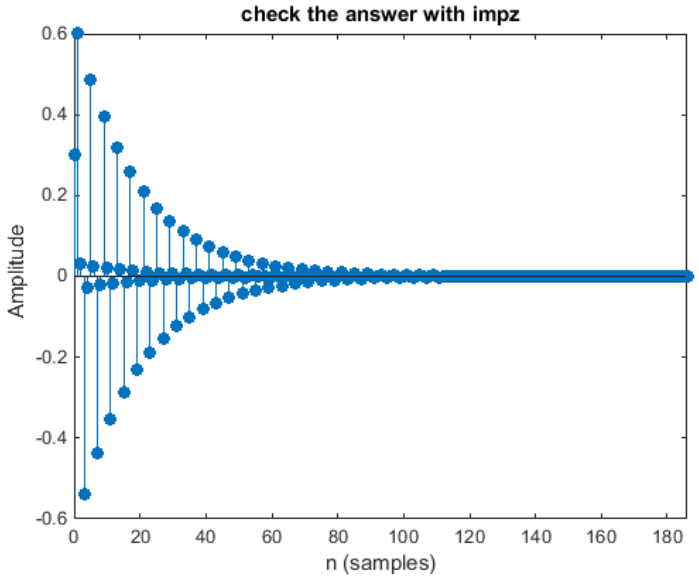
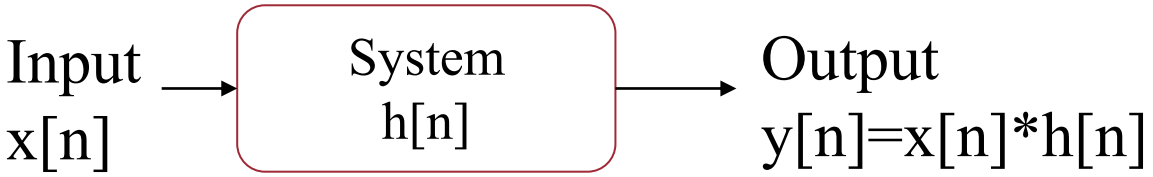
Discrete-Time System

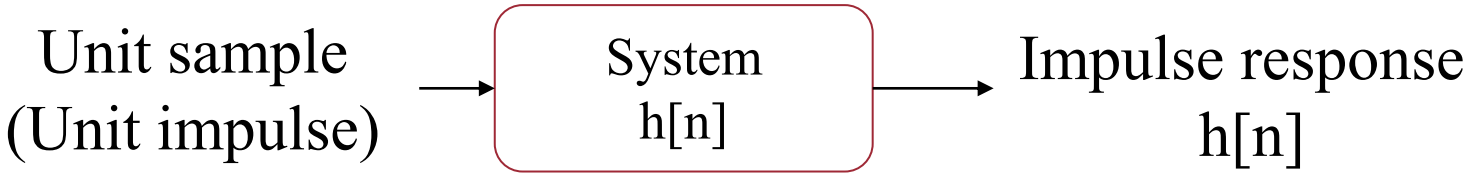


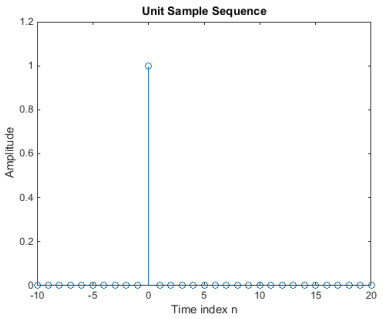

```
figure, impz(b,a);

title('check the answer with impz');
```

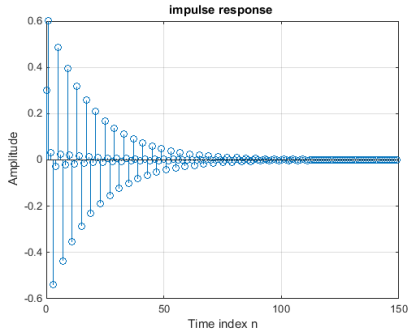


Determine the impulse response od unknown system









Is the same as the previous one?

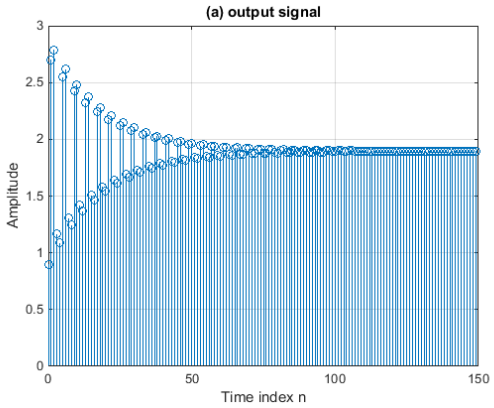
Steady state & transient resposes

$$y[n] = y_{ss}[n] + y_t[n]$$

Steady State Response

Transient Response

When X[n]=3u[n]



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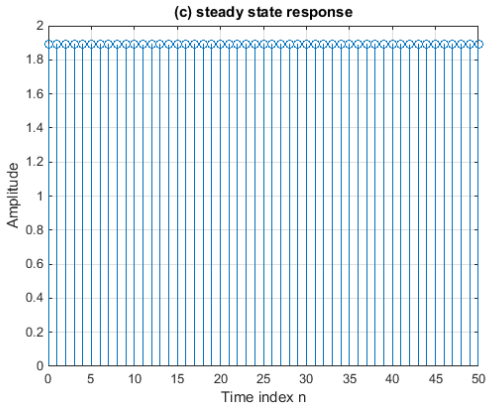

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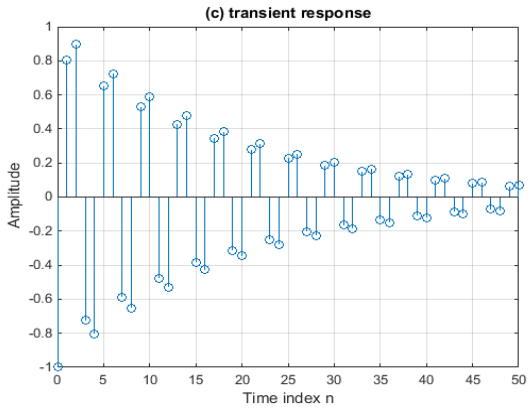
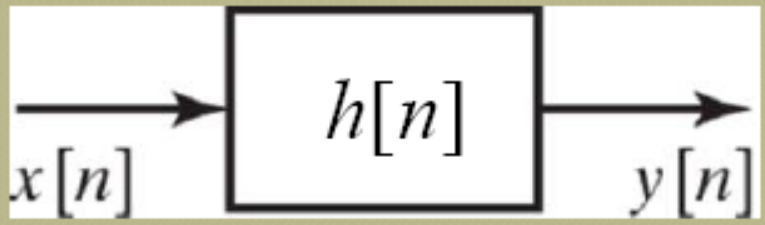


Complex exponential

Consider a LTI system



- If $x[n]$ is a complex exponential (or sinusoid)
  Then $y[n]$ is a complex exponential (or sinusoid)
  - Same frequency as $x[n]$
  - Amplitude and phase determined by the system

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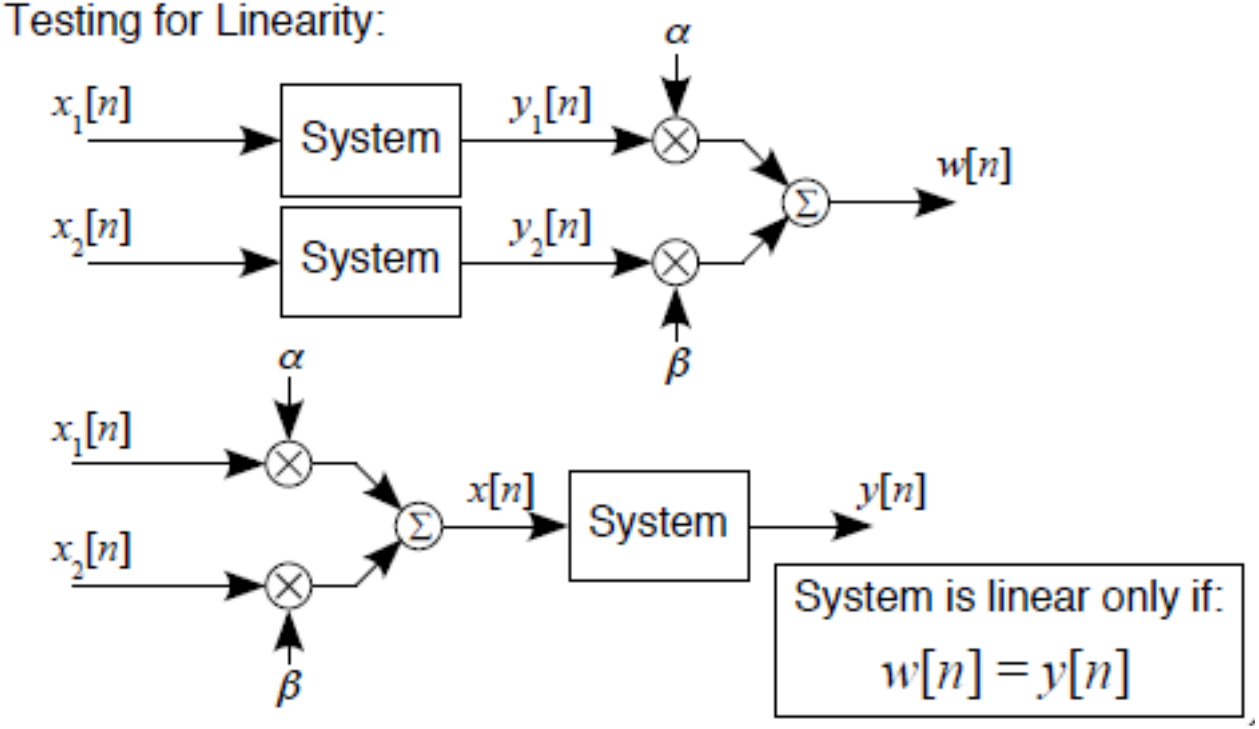
Linearity Test

Testing for Linearity:



Complete all the assignment .

Thanks