

ECE 311 Lab 3

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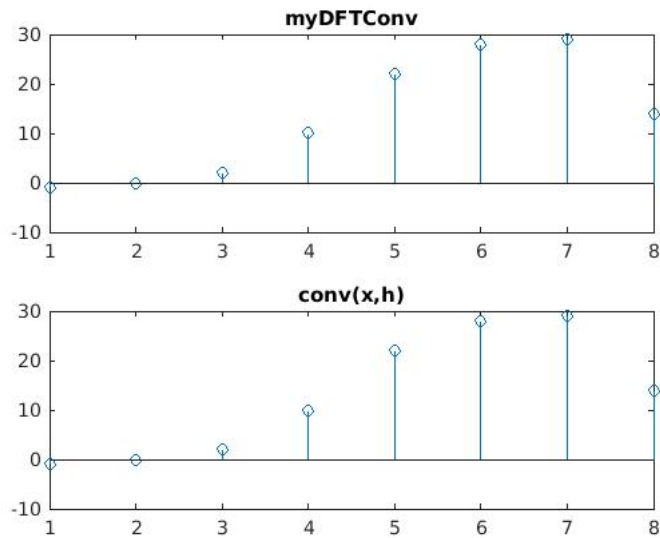
March 4, 2017

```

1 function [ y ] = myDFTConv( x, h )
3 %transfer over to frequency domain
  l = size(x,2) + size(h,2) - 1;
5 x_w = fft(x,l);
  h_w = fft(h,l);
7
9 %element multiplication to get y_w
  y_w = x_w.*h_w;
11 %return to discrete domain
  y = ifft(y_w);
13
15 %plot my result
  figure;
  subplot(211);
  stem(y);
  title('myDFTConv');
19
21 %plot key
  subplot(212);
  stem(conv(x,h));
  title('conv(x,h)');
23
25 end

```

myDFTConv.m



Because of the use of fft and ifft, the time coplexity is also $O(N\log(N))$.

```

1 function [ y_n ] = sys1( a,N )
3 %get delta function
  x_n = zeros(1,N);
5 x_n(1) = 1;

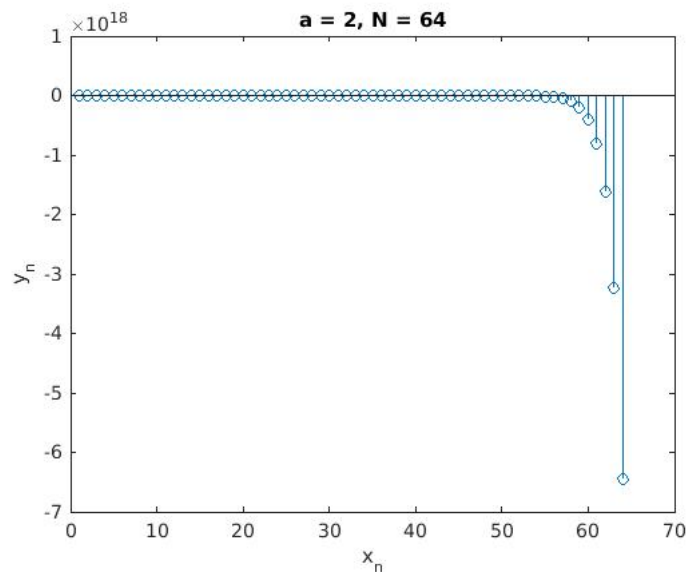
7 %get shifted delta function
  x_n_1 = zeros(1,N);
9 x_n_1(2) = 1;

11 y_n = zeros(1,N+1);

13 for i = 1:N,
    y_n(i+1) = a.*y_n(i) + 0.3.*x_n(i) -2.*x_n_1(i);
15 end
  y_n = y_n(2:length(y_n)); % remove first element to get to N
17 figure;
  stem(y_n);
19 title('a = 2, N = 64');
  ylabel('y_n');
21 xlabel('x_n');
  end

```

sys1.m



Notice that this function is in the order of $-e^x$ therefore, it is not stable $\lim_{x_n \rightarrow \infty} y_n = -\infty$. The system is causal, however, by the finite difference equation, output only depends on past or current inputs.

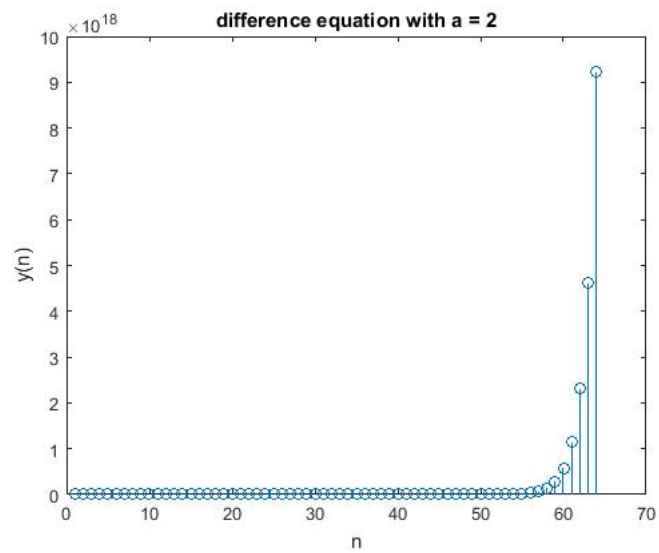
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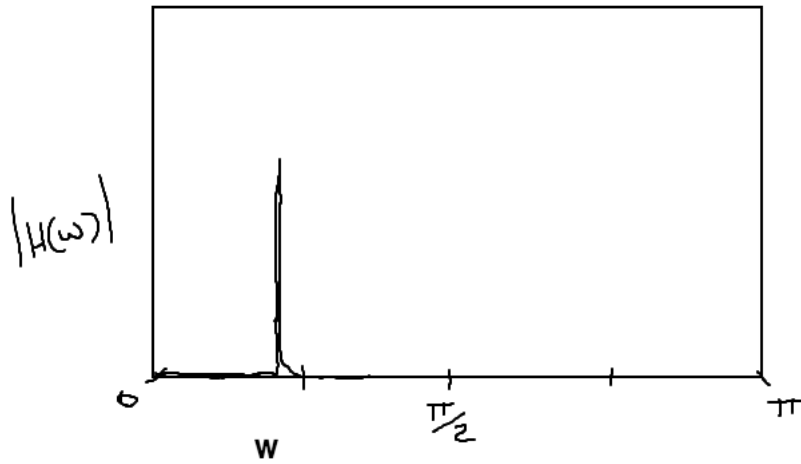
1 function [ y_n ] = sys2( x_n, a )
N = 64; % length always 64
3 y_n = zeros(1,N+1);

5 for i = 1:64,
    y_n(i+1) = a*y_n(i) + x_n(i).^2;
7 end
    y_n = y_n(2:length(y_n)); % remove first element to shorten to
    64
9
    figure;
11 stem(y_n);
    title('difference equation with a = 2');
13 xlabel('n');
    ylabel('y(n)');
15 end

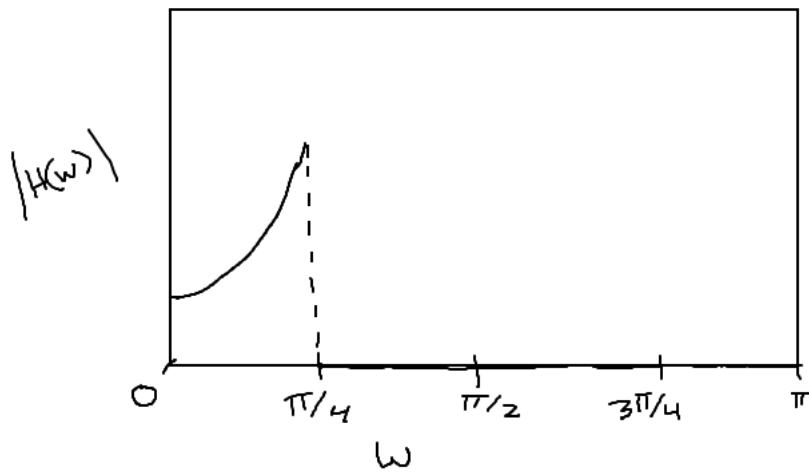
```

sys2.m





We can see on the interval from $\omega = 0$ to π , that there is only one point where the magnitude is not zero. Therefore, there is a spike at that point.



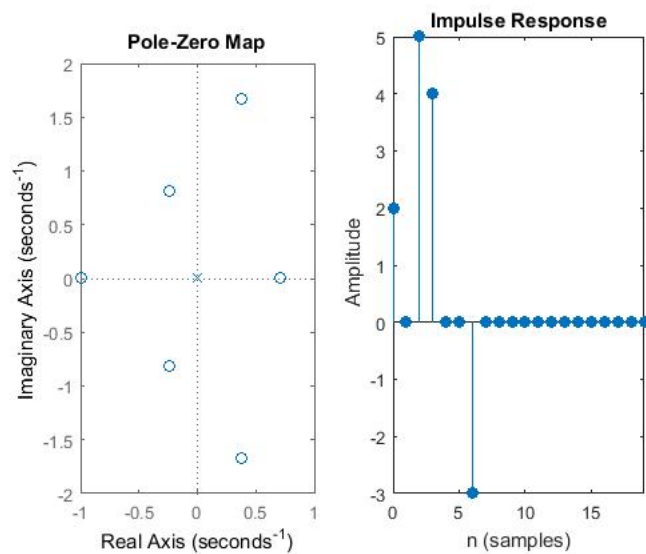
We can see on the interval from $\omega = 0$ to π that there is a minimum at $\omega = 0$ and a maximum at $\omega = \pi/4$ so the graph is increasing until that point.

```

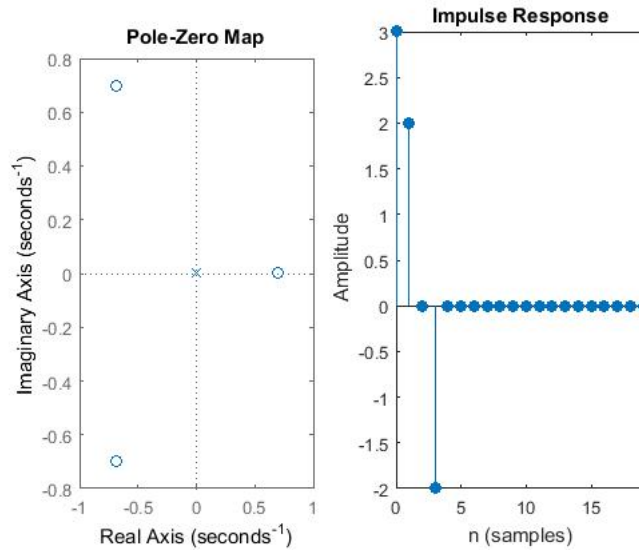
function [ ] = pzplot_impz( a,b )
2 S = tf(b,a);
  N = 20;
4
  figure;
6 subplot(121);
  pzplot(S);
8 subplot(122);
  impz(b,a,N);
10 end

```

pzplot_impz.m

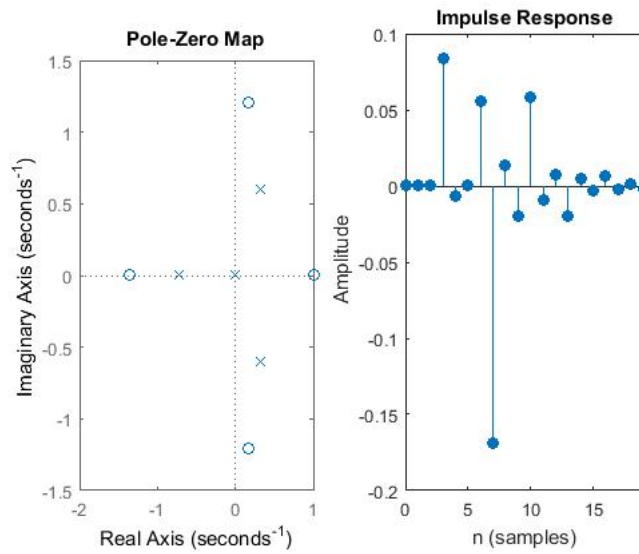


With $a = [1, 0, 0, 0, 0, 0, 0]$ and $b = [2, 0, 5, 4, 0, 0, -3]$ There are no poles on the unit circle so the system is most likely stable.



[1, 0, 0, 0] and $b = [3, 2, 0, -3]$

With $a =$



[12, 1, 0, 4, 0, 0, 0, 0] and $b = [0, 0, 0, 1, 0, 0, 1, -2]$

With $a =$

$$H(z) = z / ((z + e^{i8\pi/10})(z + e^{-i8\pi/10})) = z / (z^2 + 2\cos(4\pi/5)z + 1) = (z^{-1}) / (1 + z^{-1}2\cos(4\pi/5))$$

$a = [1, 2\cos(4\pi/5)], b = [0, 1]$