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Project 2

Introduction:

This report will detail the calculated system response of the following function:

$$y[n+1] - 0.5\, y[n] = x[n]$$

These calculations were done utilizing MATLAB. In order to properly get the system response, we utilized MATLAB to get the amplitude plot and phase plot.

Process:

In order to plot the difference equation, we first have to represent it in its transfer function form. We can do this in MATLAB by breaking down the respective function into its coefficients, which is represented below:

```
H = tf([1 0],[1 -.5], -1);
```

The values 1 and -.5 are for the y[n] values, and the 1 and 0 are for the x[n]. With this code, we now represent the transfer function of the difference equation as H. In order to plot the difference equations phase and amplitude, we use the MATLAB commands angle() and abs(). Below you can see the code to plot the respective graphs.

```
%Setup
Omega = linspace(-pi,pi,400);%sets up omega range
H = tf([1 0],[1 -.5], -1);%Transfers the difference equation into a transfer function
H_Omega = squeeze(freqresp(H,Omega));

%plot of the amplitude
subplot (2,1,1);
stem (Omega, abs(H_Omega), 'k');
axis tight;
xlabel ('\Omega');
ylabel('|H[e^{j \Omega}]|');
%plot of the phase
subplot (2,1,2);
stem (Omega, angle (H_Omega) * 180/pi, 'k');
axis tight;
xlabel ('\Omega');
ylabel ('\angle H[e^{j \Omega}] [deg]');
```

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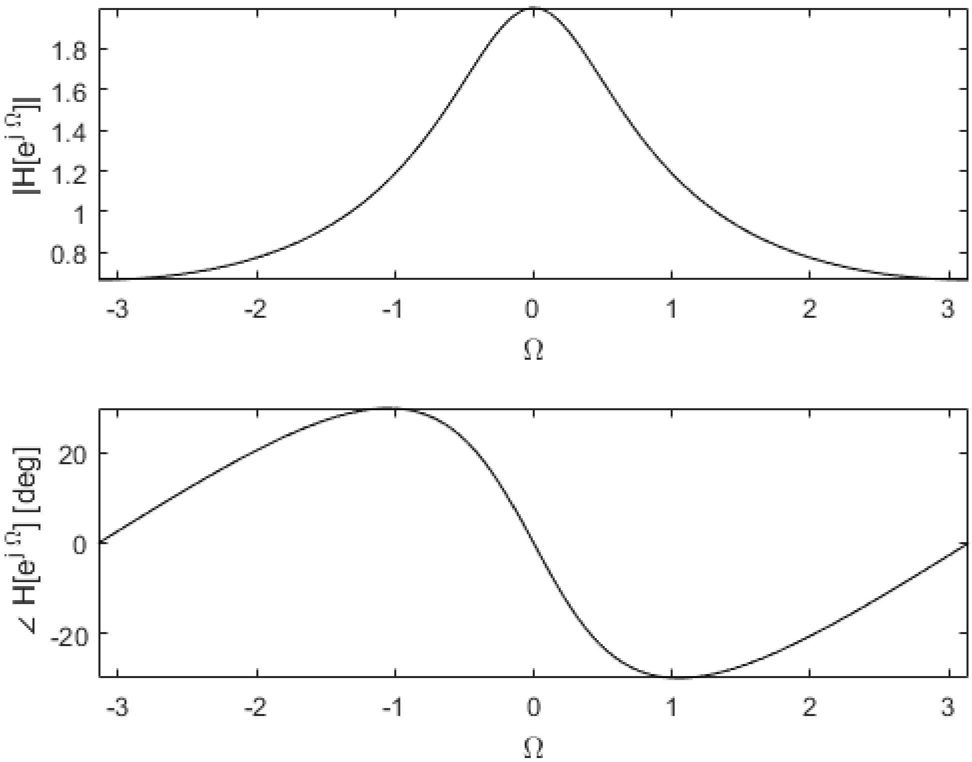
This code results in the following graphs:



From the phase and amplitude plots we can see each respective property of our original difference equation. These phase and amplitude plots indicate that the frequency response of a discrete-time system is continuous function of frequency Omega. From this we can draw that the system response exists at every value of Omega.

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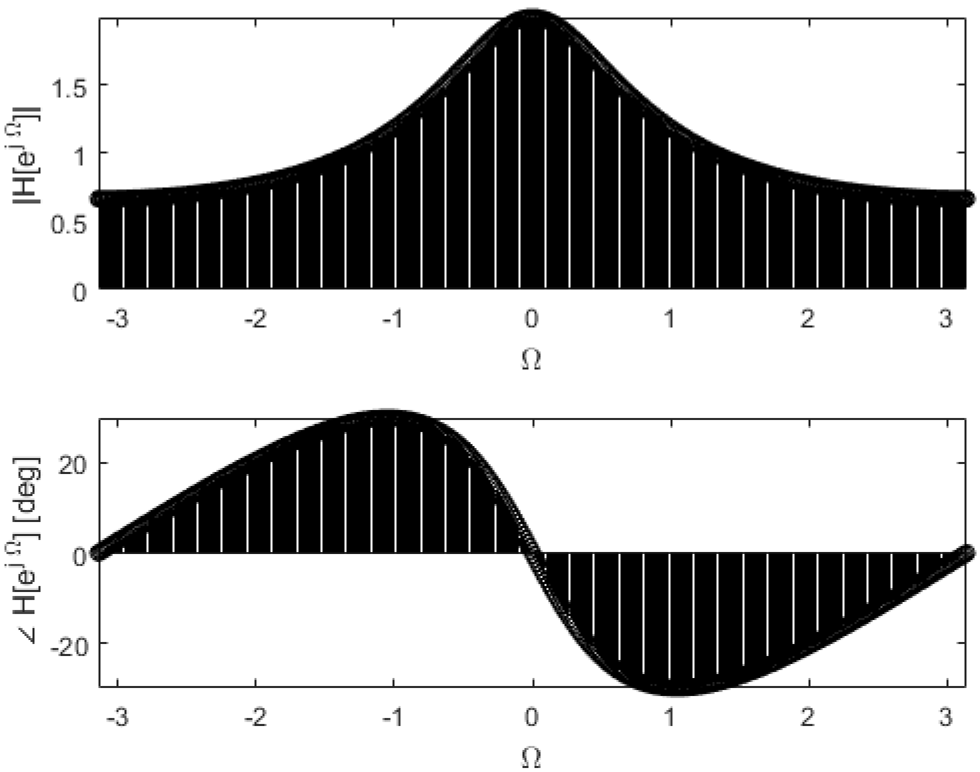
Plotting the phase and amplitude utilizing the stem() command gives the following graphs.



The graphs resulting from the stem command of the difference equations amplitude and phase are much more to something we expect to see when working in the discrete time domain and shows our data points clearly.