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Math 362 Fourier Analysis

September 26, 2017

Ch. 3.5 HW

Section 3.5

3.5.12

1. Find the values of the coefficients for
2. Express the magnitudes in vector form **c**; i.e., find **c** = [].
3. Adapt the timefreqplot(a0, a, b, ymin, ymax) program to plot the time and frequency domain graphs of . Be sure to first enter as well as the coefficient vectors **a** and **b** for each problem. Show MATLAB commands used.

a.)



b.)

**c** =

c.)

|  |  |
| --- | --- |
| Input Command | Output Plots |
| >> a0=2;  >> a=[2,0,0,0,2,5,4,0,0];  >> b=[0,0,0,0,0,0,0,0,0];  >> timefreqplot(a0,a,b,-10,10) |  |

3.5.25

1. After some experimentation, choose a reasonable value of and plot the time domain graphs of and in one plot and the frequency domain graph of in a second plot. Show MATLAB command used.
2. Describe the frequency spectrum of . Are there mostly low frequency terms? Are there high frequency terms? Do the coefficient magnitudes approach zero as , and if so, how quickly? Briefly discuss.

a.)

|  |  |
| --- | --- |
| Input Commands | Output Plots |
| >> boxtimefreqfcn(30) |  |

b.)

The frequency spectrum of this function tends to consist of lower frequencies. There are high frequencies it’s just that the lower ones are more dominant. This can be seen if you look at the frequency domain graph. This graph has a lot of lower frequencies and that tend to zero as approaches infinity. The periodic extension of this function is discontinuous and therefore decays to zero at the rate of .

3.5.27

1. After some experimentation, choose a reasonable value of and plot the time domain graphs of and in one plot and the frequency domain graph of in a second plot. Show MATLAB command used.
2. Describe the frequency spectrum of . Are there mostly low frequency terms? Are there high frequency terms? Do the coefficient magnitudes approach zero as , and if so, how quickly? Briefly discuss.

a.)

|  |  |
| --- | --- |
| Input Commands | Output Plots |
| >> boxtimefreqfcn(15) |  |

b.)

The frequency domain graph indicates that there are primarily lower frequencies in this function. There are plenty higher frequencies it’s just that the lower ones are more dominant. The difference in this function from the previous is that the periodic extension of is continuous. Since its derivatives are constants of this function, we can also say the derivative of is continuous. Therefore, with this given information we can conclude that coefficient magnitudes approach zero at the rate of .

3.5.40

1. Use the MATLAB commands [x,sr] = audioread(‘filename.wav’) and SoundWaveTimeFreq(x,sr,TZL,TZR,FZL,FZR) to load the sound wave x and plot the time and frequency domain graphs of x.
2. What are the first several dominant frequencies of the sound wave?

“Hello World”

a.)

|  |  |
| --- | --- |
| Input Commands | Output Plots |
| >> [x,sr]=audioread('helloworld.wav');  >> SoundWaveTimeFreq(x,sr,0.5,0.6,100,150) |  |

b.)

The first couple dominant frequencies that can be found in the frequency domain plots are in the range of 100 Hz to 150 Hz. To be really specific, the really first very dominant frequency seems to lie at about 120 Hz or so. As for the rest of the graph in this region, there seems to be a good distribution of dominance amongst the frequency ranges.