Notes on ECEN220 Signals and Systems Lab 3

Part 1 Fourier Transform of cosine signal

In lecture we have learnt that the Fourier Transform of cosine signal is a delta function shifted to both the +/- of the signal's frequency. Here, you will use Matlab to confirm this theory.

Note that for Matlab, being a computational software, will have some limitations, for example, when the time resolution of the time-domain signal is not high enough, the plot of the frequency domain may not give a "perfect" delta. This is what you will investigate.

Matlab has a built-in function that will automatically compute the Fourier Transform for us. It is the fft ( ) command. You may use this command directly; use "help" to study more about the fft ( ) function. Note that fft ( ) will not shift the zero-frequency component to the middle of the plot, so the resultant plot may not look like a delta at +/- frequency. In order to move the zero-frequency component to the middle of the plot, you will have to use fftshift ( ). But how to use it? You will need to find out by yourself.

Another thing to take note is that, the Fourier coefficients are in general complex in nature. We have learnt that for a given complex quantity, it can be expressed into a corresponding magnitude and angle component (i.e. polar form). The respective plot will then give us the magnitude plot, and the phase plot. To do this, you will need to use abs ( ) and angle ( ). Use "help" to learn more about these functions.

Part 2 Fourier Transform of more functions/signals

Investigate the Fourier Transform (FT) of more signals. Follow the general approaches of Part 1. To help you better understand the Matlab results and what to expect, you are advised to try compute the FT of the signals by analytical calculations too.

Part 3 Extensions for the motivated

Follow the general approaches similar to Part 1 and 2.

"Happy Matlab-ing and Fourier Transform-ing" 😊