ECE4522/ECE5514/ECE9524 F'14

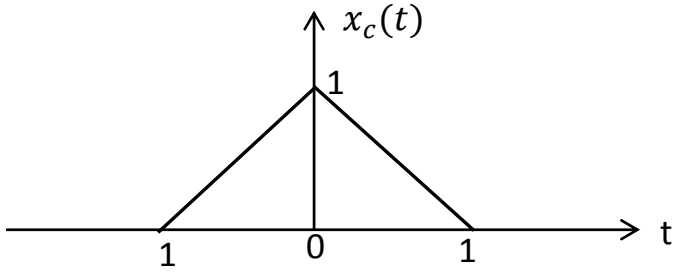
Matlab Assignment 2

Due date: Oct 8

Consider a discrete-time signal x[n] generated by periodic sampling of the following continuous time signal

$$x_c(t) = \begin{cases} 1 - |t| & |t| \le 1 \\ 0 & |t| > 1 \end{cases} \qquad (1)$$

$$x[n] = x_c(nT) \qquad (2)$$



Consider the moving-average system defined by

$$y[n] = \frac{1}{M_1+M_2+1} \sum_{k=-M_1}^{M_2} x[n+k] \qquad (3)$$

where M_1, M_2 are positive integers.

Implement a Matlab program that performs the following tasks:

1. Use equation (3) to find out y[n] and the impulse response h[n], and plot x[n], y[n] and h[n];
2. Calculate the DTFT of x[n], y[n] and h[n], i.e. $X(e^{j\omega}), Y(e^{j\omega})$ and $H(e^{j\omega})$, and plot their magnitude and phase over $[-\pi, \pi]$;
3. Since the system is LTI, $Y(e^{j\omega})$ can be derived as

$$Y(e^{j\omega}) = X(e^{j\omega})H(e^{j\omega}) \qquad (4)$$

Calculate $Y(e^{j\omega})$ using equation (4) and plot its magnitude and phase. Verify that you get the same result as in step 2.

4. Plot the zeros and poles of the Z-transforms of x[n], y[n] and h[n]. What conclusion can you make about the poles and zeros of $Y(e^{j\omega})$ given the poles and zeros of $X(e^{j\omega})$ and $H(e^{j\omega})$?

Experiment with different values of T, M_1 and M_2.

Consider using the following Matlab functions to compute DTFT and generate plots:

- exp( )
- mag( )
- angle( )
- zplane ()

Please submit your Matlab code (as an M-file) through Blackboard.