EE331 Signals & Systems

Convolution of Signals (Lab-2)

1. Remember that the discrete convolution of two sequence $x(n)$ and $h(n)$ is expressed as

$$y(n) = x(n) * h(n) = \sum_{k=-\infty}^{\infty} h(k)x(n-k) \quad (1)$$

Write your own discrete convolution function by following the steps below:

- Make the two input signals as row vectors
- Flip one of the inputs
- Perform necessary zero paddings
- Slide the flipped signal until calculation is over

Please note that you will be graded on these steps! Do not use any MATLAB built-in function (i.e. *conv(), convn(), filter(), fft(),…*)

Check the validity of your convolution function by comparing the results obtained from MATLAB's built-in convolution function. Perform the steps below:

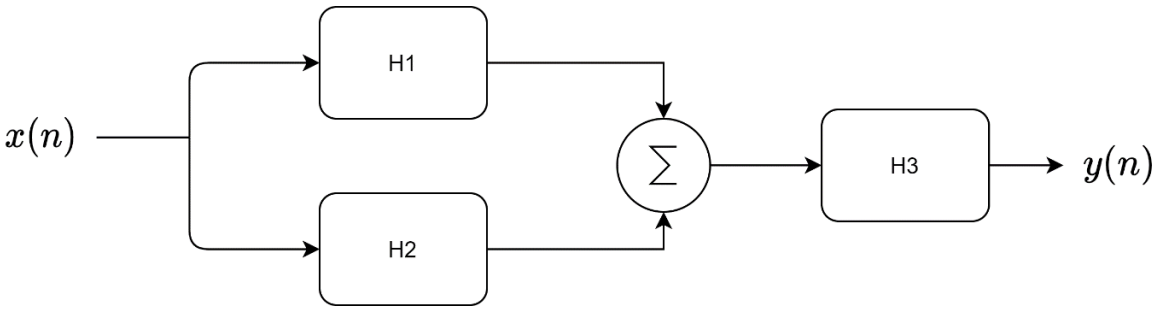
- Generate two $1x20$ dimensional random sequences (i.e.x and h) by using $randn()$ function.
- Carry out a convolution via your convolution function (i.e. $y1 = yourConvFun(x, h)$)
- Carry out a convolution via MATLAB's $conv()$ function (i.e. $y2 = conv(x, h)$)
- Check whether $y1$ and $y2$ are equal or not. Use plot(y1, y2) to show the similarity of these signals.

2. Assume that you have a system composed of three different subsystems H_1, H_2, and H_3. Their impulse responses are given as

$$h_1(n) = \delta(n-1) + \delta(n+1)$$
$$h_2(n) = u(n) - u(n-4)$$
$$h_3(n) = \delta(n-1)$$

a) Plot these impulse responses via stem command into a single figure by using subplot command.

The block diagram of the system given as follows



b) For the given signal $x(n) = \cos(\pi n)\big(u(n) - u(n-6)\big)$, perform necessary operation by using $h_1(n), h_2(n)$, and $h_3(n)$ subsystems and plot the resulting output $y(n)$. Clearly indicate the labels (time and amplitude) of the axes in your figures.