ECE -512 Digital Signal Processing

Home Work – 2

#1. Consider the causal system:

$$y[n] - 0.4y[n-1] + 0.75y[n-2] = 2.2403x[n] + 2.4908x[n-1] + 2.2403x[n-2]$$

Simulate inputs x1 and x2 in MATLAB:

$x1 = \cos(2\pi f_1 n)$
$x2 = \cos(2\pi f_2 n)$

Assume $f_1 = 0.1$, $f_2 = 0.4$ for $x_1[n]$ and $x_2[n]$. Compute $y_1[n]$ & $y_2[n]$.

If $x[n] = a\, x_1[n] + b\, x_2[n]$ where a = 2, b = 0.4, compute y[n] and also check for linearity.

Now assume N = 10, a = 3, b = – 2. Compute y[n] – y[n+N]. Also compute and plot the impulse response. Use MATLAB.

#2. System 1: $y[n] + 1.6y[n-1] + 2.28y[n-2] + 1.325y[n-3] + 0.68y[n-4] = 0.06x[n] - 0.19x[n-1] + 0.27x[n-2] - 0.26x[n-3] + 0.12x[n-4]$

Find impulse response of this system and plot.

The above system can be realized as a cascade of two second order systems as shown below

System 2:

$$y_1[n] + 0.9\, y_1[n-1] + 0.8\, y_1[n-2] = 0.3x[n] - 0.2x[n-1] + 0.4x[n-2]$$
$$y_2[n] + 0.7\, y_2[n-1] + 0.85\, y_2[n-2] = 0.2\, y_1[n] - 0.5\, y_1[n-1] + 0.3\, y_1[n-2]$$

Find impulse response of each of these two second order system and plot. Verify that the cascaded impulse response of system 2 matches with that of system 1. Use MATLAB.