

AV 331 : DIGITAL SIGNAL PROCESSING LAB

Labsheet – 3

1. Find solution for $y[n]$ from difference equation $y[n] = ay[n-1] + x[n]$, with $x[n] = \delta[n]$ and simulate it using **"filter"** command. Can you relate it to any of the standard signals?
2. Use **"filter"** function to generate and plot the impulse response $h[n]$ of the following difference equation:
 - i) $y[n] = z_0 y[n-1] + x[n]$ where $z_0 = 0.8e^{j\pi/3}$
 - ii) $y[n] - 1.8 \cos(\pi/16) y[n-1] + 0.81 y[n-2] = x[n] + 0.5x[n-1]$ in the range $-10 \leq n \leq 100$
3. Consider the following difference equation
 - i) $y[n] - 0.4y[n-1] + 0.75y[n-2] = 2.2403x[n] + 2.4908x[n-1] + 2.2403x[n-2]$
 - ii) $y[n] + 0.71y[n-1] - 0.46y[n-2] - 0.62y[n-3] = 0.9x[n] - 0.45x[n-1] + 0.35x[n-2] + 0.002x[n-3]$
 - (a) Write a program to find the impulse response of the above equation using **"impz"** function and plot $h[n]$.
 - (b) Find the solution of $y[n]$ using **"filter"** command.
4. Use function **ztrans** to find z transform of $a^n u[n]$. Find inverse z- transform using **iztrans** and verify.?
5. Determine the output response of an LTI system. Suppose a causal LTI system has a transfer function
$$\frac{z^{-1} + 3}{(1 - 0.5z^{-1})(1 + 0.25z^{-1})}$$
. Assume the z-transform of the signal is $X(z) = \frac{1 - z^{-1}}{1 - 0.6z^{-1}}$
 - (a) Plot the pole zero maps for $H(z)$, $X(z)$, $Y(z)$.
 - (b) Plot the impulse response $h[n]$.
 - (c) Plot the output signal $y[n]$.
6. Generate the rectangular pulse signal of appropriate size. Use MATLAB function **"fft"** to find the Fourier Transform. Write in brief, about your observations.
7. Generate a sinusoidal signal of length 0.5 seconds with frequency 100Hz, sampled at 8000Hz. Plot the magnitude and phase spectrum of the Fourier transform. Write, in brief, about your observations.
8. Generate a dual tone signal by adding two sinusoidal signals of length 0.5 seconds and frequencies 852 Hz and 1400 Hz. Use the appropriate sampling frequency?
9. Generate and play sinusoidal and square wave signal of length 2 seconds with frequency 500 Hz, sampled at 22050 Hz.?
10. Download the audio files provided during lab. Find the frequency content of the given signal?