SEAS Winter 2020
Semester-6
Digital Signal Processing

LAB 5

Objectives:

Understand different concepts of Z-transform

Prerequisites:

- Z-transform and its properties, Inverse z-transform, Concept of ROC

Explore Following Commands:

- **syms**
- **ztrans**
- **zplane**
- **iztrans**
- **impz**

Problems

1. Create single matlab script and obtain Symbolic Z-Transform of following signals. Use **ztrans** command to obtain z-transform and use **syms** command to construct symbolic variables. Display output on command window and take screenshots.

    a. X(n)= u(n)
    b. X(n)= nu(n)
    c. X(n) = (1+n) u(n)
    d. X(n) = $\cos(\omega 0n)$ u(n)
    e. X(n) = $\sin(\omega 0n)$ u(n)
    f. X(n) = $a^n \cos(\omega 0n)$ u(n)
    g. X(n) = $a^n \sin(\omega 0n)$ u(n)
    h. X(n) = $n\ a^n$u(n) ;
    i. X(n) = $-\ na^n$u($-n-1$) ;
    j. X(n) = $n\ (-1)^n$u(n)
    k. X(n) = $(n)^2$u(n)

2. Plot poles and zeros of the Z-transform obtained for following signals using **zplane** command. (Write in single matlab script)

   a. X(n) = $\left(\frac{1}{2}\right)^n$ u(n) + $\left(-\frac{1}{3}\right)^n$ u(n)

   b. X(n) = $\left(-\frac{1}{3}\right)^n$ u(n) - $\left(\frac{1}{2}\right)^n$ u(-n-1)

   c. X(n) = $\left(\frac{1}{2}\right)^n$ u(-n)

   d. X(n) = {-1,0,-1,0,-1,0,-1,0,-1…….}
      ↑

3. Create single matlab scipt and obtain Symbolic Inverse Z-Transform of following signals using i**ztrans** command and use **syms** command to construct symbolic variables. Display output on command window and take screenshots.

   a. X(z) =$\left(\frac{1+3\,z^{-1}}{1-3\,z^{-1}+2\,z^{-2}}\right)$

   b. X(z) =$\left(\frac{1+2\,z^{-1}}{1+\,z^{-2}}\right)$

   c. X(z) =$\left(\frac{1}{(1-\,z^{-1})^{\,2}\;(1-2\,z^{-1})}\right)$

4. Plot poles and zeros of the Z-transform obtained for following signals using **zplane** command. Also obtain impulse response of following system using **impz** command. Take impulse response length n = 16 to plot impulse response. Create a matlab script of each one of the following system to obtain pole-zero plot and impulse response.

   a. Y(n) = 0.75 y(n-1) – 0.125 y(n-2) +x(n)

   b. Y(n) = y(n-1)+x(n)

   c. Y(n)= 0.7 y(n-1) - 0.1 y(n-2) + 2 x(n) – x(n-2)