Lab #5

Objectives

- Z-transform, Z^+-transform, and reverse Z-transform

Report

1. Your report must include your answers in hand-written or computer-aid tools (word, latex).
2. Do not share your report with your friends.
3. Finally, you upload your report to BKeL on time.

EXERCISES

Exercise 1. Use Z-transform to find impulse response h(n) of the system represented by the following input-ouput description equation.

$$y(n) - y(n-2) = x(n)$$

Exercise 2. Use Z and Z^{-1} transform to compute the convolution

a. $x_1(n) = \{1\uparrow, 2, 3, 4, 5\}$ and $x_2(n) = \{1\uparrow, 1, 1\}$

b. $x_1(n) = \left(\frac{1}{5}\right)^n u(n)$ and $x_2(n) = 2^n u(n)$

c. $x_1(n) = nu(n)$ and $x_2(n) = 2^n u(n-1)$

Exercise 3. Find all possible x(n) that has Z^{-1} transform as follows

a. $X_1(z) = \frac{1}{2 - 3z^{-1} + z^{-2}}$

b. $X_2(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 + 4z^{-1} + 4z^{-2}}$

c. $X_3(z) = \frac{1 + z^{-1}}{(1 - 0.5z^{-1})^2(1 - 0.3z^{-1})}\ 0.3 < z < 0.5$

Exercise 4. Given LTI system by the following input-ouput description equation

$$y(n) = 0.7y(n-1) + x(n)$$

a. Draw the block diagram of the above system

b. Determine h(n)

c. Determine y(n) when x(n) = u(n)

Exercise 5. Given LTI system by the following input-ouput description equation

$$y(n) = 2y(n-1) - 3y(n-2) + x(n) + x(n-1)$$

a. Draw the block diagram of the above system

b. Determine the impulse response h(n)

c. Determine $y_{zi}(n)$ when $y(-1) = y(-2) = 1$

d. Determine $y_{zs}(n)$ when $x(n) = 2^n u(n)$

Exercise 6. If $x(n) \xrightarrow{Z} X(z)$. Then, prove the following statements:

- $Z[x^*(n)] = X^*(z^*)$
- $Z\{\Re e[x(n)]\} = \frac{1}{2}[X(z) + X^*(z^*)]$
- $Z\{Im[x(n)]\} = \frac{1}{2j}[X(z) - X^*(z^*)]$
- $Z\{e^{j\omega_0 n}x(n)\} = X\{ze^{-j\omega_0}\}$

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