Lab #4

Objectives

- Analyze systems using Z-transform

Report

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

Z-TRANSFORM EXERCISES

For each discrete-time signal x(n), find the corresponding Z-Transfrom and its ROC

Exercise 1.

$$x(n) = 2\delta(n+2) - 1\delta(n+1) + 2\delta(n) - 3\delta(n-1) + 4\delta(n-2)$$

Exercise 2.

$$x(n) = 0.5^n u(n) + 0.4^n u(n)$$

Exercise 3.

$$x(n) = 0.5^n u(n) + 0.9^n u(-n-1)$$

ADDITIONAL SCILAB EXERCISES

Exercise 4.

Investigate the existing library or toolbox in Scilab to process audio data.

Exercise 5.

Investigate the existing library or or toolbox in Scilab for image processing. Then, you can do an example or a demo to show a simple manipulation (e.g., Histogram display, histogram equalization, blur, and watermarking) on a digital image.

Exercise 6.

Let there are two discrete signals $x(n), h(n), n = 0, \pm 1, \pm 2, \ldots$, defined over the entire range of n. Then the linear convolution of discrete signals is $y(n)$of the form $y(n) = \sum_{k=-\infty}^{\infty} h\,(k)x(n-k)$.

- Deprive the signal $y(n)$ such that $y(n)$ converges in the following cases.
  - Both $h(n)$and $x(n)$are causal.

- The system has a finite impulse response such that $h(n) = 0, n < 0 \vee n > M$.

- Suppose the second case is hold, compute the convolution $y(n)$ of $x(n) = [1 \uparrow, 2, -3, 2, 1]$and $h(n) = [1 \uparrow, 0, -1]$using "folding and shifting" method. Implement your answer with Scilab script.
- Suppose the second case is hold, compute the convolution $y(n)$ of $x(n) = [1 \uparrow, 2, -3, 2, 1]$and $h(n) = [1 \uparrow, 0, -1]$using matrix method. Implement your answer with Scilab script.
- Drawing $x(n)$, $y(n)$and energy of discrete signals in the same figure.

Exercise 7.

For a periodic signal $x(n)$ of length N and impulse response $h(n)$ of length M, the circular convolution between $x(n)$and $h(n)$is defined as $y(n) = \sum_{k=0}^{M-1} h(k) x[(n - k) mod N]$. Explain why $y(n)$can be deprived that way.

- Compute the convolution $y(n)$ of $x(n) = [1 \uparrow, 2, -3, 2, 1]$and $h(n) = [1 \uparrow, 0, -1, -1, 1]$using "folding and shifting" method. Implement your answer with Scilab script.
- Compute the convolution $y(n)$ of $x(n) = [1 \uparrow, 2, -3, 2, 1]$and $h(n) = [1 \uparrow, 0, -1, -1, 1]$using matrix method. Implement your answer with Scilab script.
- Drawing $x(n)$, $y(n)$and energy of discrete signals in the same figure.

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