ECE 310 Recitation 6 Solution
Thursday Mar 25, 2021

Concept check

- √ The Big Picture So Far…
- √ System analysis
  - Linearity, Shift-Invariance
  - Causality, BIBO Stability of LSI system
- √ Z-transform: $X(z) = \sum_{n=-\infty}^{\infty} x[n]z^{-n}$
  - ROC and causality
  - Poles and zeros, 0? ∞?
  - Inverse z-transform: Partial fraction => ROC based on causality => Table look-up
  - Important pairs and properties
- √ About δ
  - $\delta(at) = \frac{1}{|a|}\delta(t)$
  - $\int_{-\infty}^{\infty} e^{j\omega t} d\omega = 2\pi\delta(t)$
  - $\sum_{n=-\infty}^{\infty} e^{jn\frac{2\pi}{\tau}t} = \tau \sum_{n=-\infty}^{\infty} \delta(t - n\tau)$
- √ CTFT and DTFT
  - Important formulas
  - Important pairs and properties

Exercise

1. (HW2 Q4) Assume that the response of an LTI system to input $x[n] = 3^{-n}u[n]$ is $y[n] = 5^{-n}u[n-1]$. Use the system's properties (linearity and shift invariance) to find $h[n]$, the system's unit pulse response.

2. (HW5 Q6) $x[n] = (u[n] - u[n-N])/N$, discuss how will the shape of $|X_d(\omega)|$ and $\angle X_d(\omega)$ change as N increases. (Estimate and sketch by hand.)

3. (fall2019 Q1) T or F
   a. An LSI system specified by the following difference equation: $y[n] - \frac{1}{2}y[n-1] = x[n]$ can be causal or anti-causal.

   b. The input and output relationship of an arbitrary system is completely determined by the system's unit pulse response.

4. (fall2019 Q5) calculate the z-transform and corresponding ROC for
$$x[n] = 3^n(u[n-5] - u[n-100])$$