HKN ECE 310 Review Worksheet 2

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1 The very basics

1. What is the relation between the Z-transform and the Discrete-Time Fourier Transform? When is this relation not valid?

2 Devious DTFTs

Use your unbounded knowledge of the DTFT properties and pairs to take the DTFT of these signals.

(i) $\delta[n-1] + (\frac{2}{3})u[n+4]$

(ii) $\cos(n)\sin(n)$

(iii) $n\delta[n-1] * e^{jn}$

3 Sampling and DTFTs

(Let the output of a radio be) Consider a signal given by

$$x(t) = 2\cos(10\pi t) + \sin(30\pi t)$$

1. What is the nyquist sampling rate of this signal?

2. Let's say the signal is sampled at twice the nyquist rate. What does the discrete-time signal look like for three samples starting at $n = 0$? What is the n'th sample?

3. Find the Discrete-Time Fourier Transform of the signal. Plot both the real and imaginary components of the DTFT over the range $(-\pi, \pi)$.

4. What is the power contained in this signal? Make sure to include units!

5. If we want to build a low-pass filter to filter out the fastest component of this signal, what is the smallest value of ω at which the filter can start attenuating?

6. Lets say we have a perfect filter to do said filtering. We then amplify the signal such that the magnitude of each component is doubled. How does the power of the signal change?