

HW#7 Fourier Transform, Fourier Series, Discrete Time Fourier Transform

#1 Write down the equations for CTFT, FS, DTFT.

#2 Derive the relationship between *rect* and *sinc* functions in CTFT, FS, DTFS.

#3 Explain the ideal low pass filter using *rect* function. Discuss the causality.

#4 What is the relationship between the ideal LPF and HPF?

#5 Draw the relationship between CTFT and DTFT. ($T \rightarrow +\infty$)

$$\begin{aligned} \text{rect}(ax) & \quad \frac{1}{|a|} \cdot \text{sinc}\left(\frac{\xi}{a}\right) \\ \text{sinc}(ax) & \quad \frac{1}{|a|} \cdot \text{rect}\left(\frac{\xi}{a}\right) \\ \text{rect}\left[\frac{(n - M/2)}{M}\right] & \quad \frac{\sin[\omega(M + 1)/2]}{\sin(\omega/2)} e^{-i\omega M/2} \\ \text{sinc}[(a + n)] & \quad e^{ia\omega} \end{aligned}$$

*) For Fourier Series, use square wave (i.e. periodic *rect* function)