Homework #02

Problem 1

(a) $x(t) = e^{-\pi|t|}$

(1) Find CTFT $X(f)$.

(2) Plot $x(t)$ and $X(f)$ using Matlab.

(b) $x(t) = e^{-\pi t^2}$

(1) Find CTFT $X(f)$.

(2) Plot $x(t)$ and $X(f)$ using Matlab.

Problem 2

$$x(t) = \sum_{n=-\infty}^{+\infty} \delta(t - nT)$$

(a) Please find $X[k]$.

(b) Please use the following form to represent $x(t)$.

$$x(t) = \frac{1}{T} \sum_{k=-\infty}^{+\infty} X[k] e^{+j\frac{k2\pi t}{T}}$$

(c) Please use the result of (b) to find $X(f)$, the CTFT of $x(t)$.

(d) When $T = 1$, what are $x(t)$ and $X(f)$?

Problem 3

$$x(t+T) = x(t)$$

$$x(t) = \begin{cases} +1, & 0 < t < +\dfrac{T}{2} \\ -1, & -\dfrac{T}{2} < t < 0 \end{cases}$$

(a) Please find $X[k]$.

(b) Please use the following form to represent $x(t)$.

$$x(t) = \frac{1}{T} \sum_{k=-\infty}^{+\infty} X[k] e^{+j\frac{k2\pi t}{T}}$$

(c) Please use the result of (b) to find $X(f)$, the CTFT of $x(t)$.

(d) When $T=1$, what are $x(t)$ and $X(f)$?

Problem 4

Please derive how to obtain the following two transforms and inverse transforms.

(a) $x[n]=\frac{1}{N}\sum_{k=0}^{N-1}X[k]e^{+j\frac{k2\pi n}{N}}$ $\qquad$ $X[k]=\sum_{n=0}^{N-1}x[n]e^{-j\frac{k2\pi n}{N}}$

(b) $x[n]=\int_{-\frac{1}{2}}^{+\frac{1}{2}}X(f)e^{+j2\pi fn}df$ $\qquad$ $X(f)=\sum_{n=-\infty}^{+\infty}x[n]e^{-j2\pi fn}$

Problem 5

(a) $x(t)=\left(\frac{3}{4}\right)^n u[n]$

(1) Find DTFT $X(f)$.

(2) Plot $x(t)$ and $X(f)$ using Matlab.