Find the CTFT of an impulse train

$$X(t) = \sum_{k=-\infty}^{\infty} \delta(t - kT)$$

$x(t)$



$-2T \quad -T \quad 0 \quad T \quad 2T \quad 3T \quad t \rightarrow$

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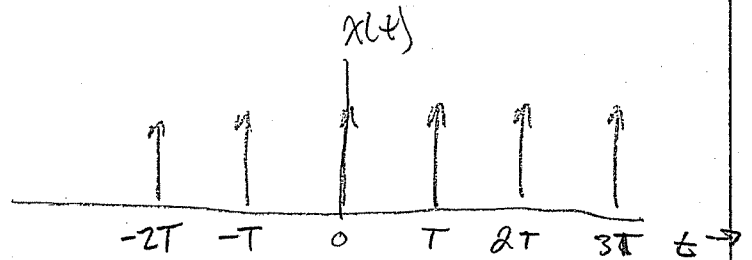
This signal is periodic, so we first have to compute the CTFS: Let $T_F = T$

$$X[k] = \frac{1}{T} \int_{-T/2}^{T/2} \delta(t) e^{-j2\pi k f_F t} \, dt \quad \boxed{= \frac{1}{T}}$$

This means that the CTFS harmonic function is **constant**, regardless of $k$

Insert CTFS into Roberts Eq $(10.18)$

$$X(f) = \sum_{k=-\infty}^{\infty} X[k] \, \delta(f - k f_F)$$

$$= \frac{1}{T} \sum_{k=-\infty}^{\infty} \delta\left(f - \frac{k}{T}\right)$$

> The CTFS of an impulse train is an impulse train!

$X(f)$

$\frac{1}{T}$



$-\frac{3}{T} \quad -\frac{2}{T} \quad -\frac{1}{T} \quad 0 \quad \frac{1}{T} \quad \frac{2}{T} \quad \frac{3}{T} \quad f \rightarrow$