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Homework 1

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1 Problem Statement

Find the synthesis equation C_k of the following fourier serie:
The sampling property of $\delta(t)$ is:

$$\int_{-\infty}^{\infty} f(t)\delta(t-a)dt = f(a) \tag{1}$$

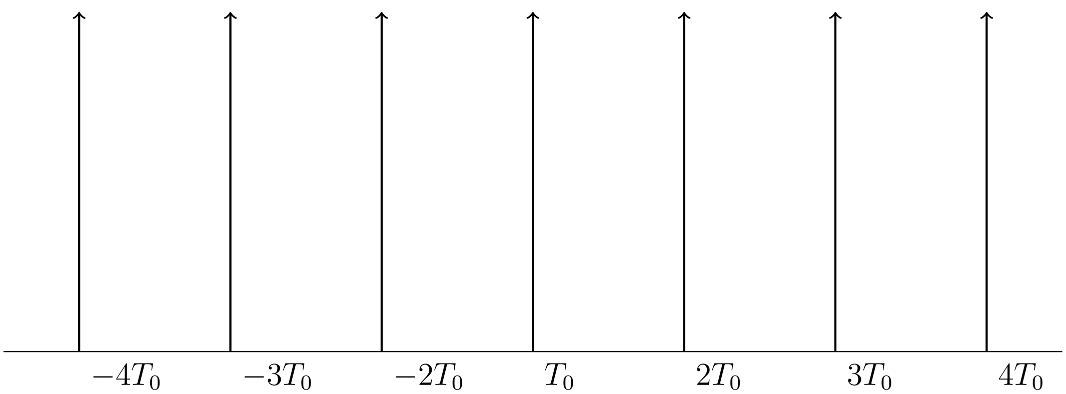

Figure 1: Representation of $\delta_{T_0}(t)$

2 Solution

$f(t) = \sum_{-\infty}^{\infty} A\delta(t - mT_0)$
$f(t) = A\delta(t)$ by replacing this into (1) we get the following equation

$$f(a) = \int_{-\infty}^{\infty} A\delta(t)\delta(t-a)dt \tag{2}$$

$f(a) = \int_{-\infty}^{\infty} A\delta(t)\delta(t-a)$

$$C_k = \frac{1}{T_0}\int_{\frac{-T_0}{2}}^{\frac{T_0}{2}} f(t)e^{-jw_0t} \tag{3}$$

with $e^{-jw_0t} = 1$ we can conclude that $C_k = \frac{1}{T_0}f(a)$
replace f(a) into this equatio yeild

$$C_k = \frac{1}{T_0}\int_{-\infty}^{\infty} A\delta(t)\delta(t-a)dt \tag{4}$$

The integral is zero ouside the interval of $-T_0$ and T_0, thus

$$C_k = \frac{1}{T_0}\int_{\frac{-T_0}{2}}^{\frac{T_0}{2}} A\delta(t)\delta(t-a)dt \tag{5}$$

The area under any impulse signal is always zero. therefore we have

$$C_k = \frac{A}{T_0} \tag{6}$$