GATE ASSIGNMENT 4

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Download latex-tikz codes from

https://github.com/Dishank422/EE3900/blob/main/Gate-Assignment4/latex_code.tex

1 EC 1999 Q.2.1

The Fourier representation of an impulse train represented by $s(t) = \sum_{n=-\infty}^{\infty} d(t - nT_0)$ is given by

(a) $\frac{1}{T_0} \sum_{n=-\infty}^{\infty} exp - \frac{j2\pi nt}{T_0}$

(b) $\frac{1}{T_0} \sum_{n=-\infty}^{\infty} exp - \frac{j\pi nt}{T_0}$

(c) $\frac{1}{T_0} \sum_{n=-\infty}^{\infty} exp \frac{j\pi nt}{T_0}$

(d) $\frac{1}{T_0} \sum_{n=-\infty}^{\infty} exp \frac{j2\pi nt}{T_0}$

2 Solution

We observe that $s(t)$ is periodic with period T_0. Thus it's Fourier representation as a sum of complex exponentials is given by

$$s(t) = \sum_{n=-\infty}^{\infty} a_n exp \frac{j2\pi nt}{T_0} \tag{2.0.1}$$

where, a_k is given by

$$a_n = \frac{1}{T_0} \int_{-\frac{T_0}{2}}^{\frac{T_0}{2}} s(t) exp - \frac{j2\pi nt}{T_0} dt \tag{2.0.2}$$

Between $-\frac{T_0}{2}$ and $\frac{T_0}{2}$, we can say that $s(t) = d(t)$.

$$\implies a_n = \frac{1}{T_0} \int_{-\frac{T_0}{2}}^{\frac{T_0}{2}} d(t) exp - \frac{j2\pi nt}{T_0} dt \tag{2.0.3}$$

$$= \frac{1}{T_0} \tag{2.0.4}$$

$$\implies s(t) = \frac{1}{T_0} \sum_{n=-\infty}^{\infty} exp \frac{j2\pi nt}{T_0} \tag{2.0.5}$$

Therefore option (d) is the correct option.