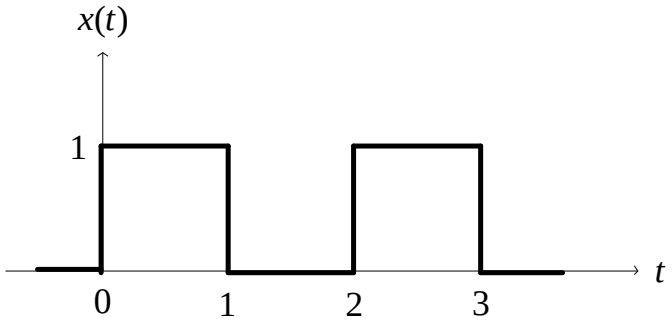
EE 207-02-Winter 2015(142)
QZ1

Sec	Ser	ID	Name

Q1

Let $x(t)$ be a periodical function as shown below



Find Complex Fourier Series Coefficient X_n ?

Solution

$$T_0 = 2 \quad \Rightarrow \omega_0 = \frac{2\pi}{T_0} = \frac{2\pi}{2} = \pi$$

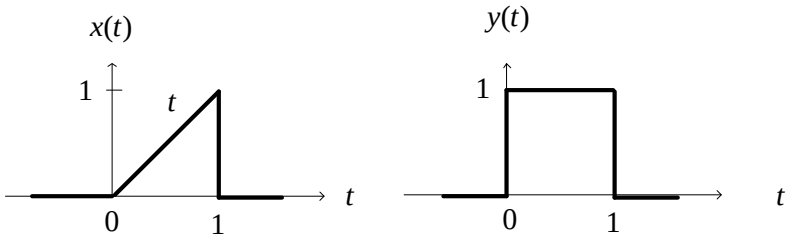
$$X_0 = \frac{1}{T_0}\int_{T_0} x(t)dt = \frac{1}{2}\int_0^1 (1)dt = \frac{1}{2}$$

$$X_n = \frac{1}{T_0}\int_{T_0} x(t)e^{-jn\omega_0 t}dt = \frac{1}{2}\int_0^1 (1)e^{-jn\pi t}dt = \frac{1}{2}\frac{e^{-jn\pi t}}{(-jn\pi)}\Bigg|_0^1$$

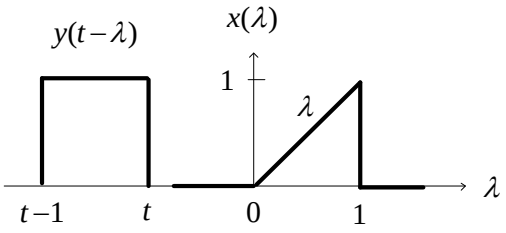
$$= \frac{j}{2n\pi}\left[e^{-jn\pi(1)} - e^{-jn\pi(0)}\right] = \frac{j}{2n\pi}\left[e^{-jn\pi} - 1\right] = \begin{cases} 0 & n \text{ even} \\ \dfrac{1}{jn\pi} & n \text{ odd} \end{cases}$$

Q2

Let $x(t)$ and $y(t)$ be two signals as shown below:



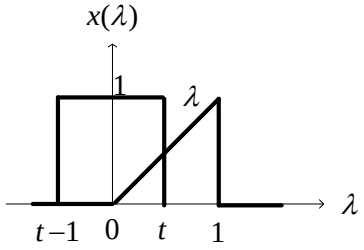
Evaluate the convolution $x(t)*y(t)$?



Solution

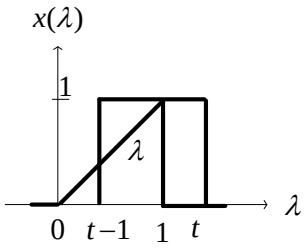
$t<0$ No overlapping $\Rightarrow$ $x(t)*y(t)=0$

$0<t<1$



$$x(t)*y(t)=\int_0^t(\lambda)(1)d\lambda=\frac{t^2}{2}$$

$1<t<2$



$$x(t)*y(t)=\int_{t-1}^1(\lambda)(1)d\lambda=-\frac{t^2}{2}+t$$

$t>2$ No overlapping $\Rightarrow$ $x(t)*y(t)=0$

$$x(t)*y(t)=\begin{cases}0 & t<0\\ \frac{t^2}{2} & 0<t<1\\ -\frac{t^2}{2}+t & 1<t<2\\ 0 & t>2\end{cases}$$