Jonathan Sumner

Lab 8 – Square Wave

EEET-332.01 – Signals, Systems, and Transformers Lab

Due Date: 11/10/2024

Section 1:

1) $c_m = \frac{1}{T_O}\int_{-0.25ms}^{0.75ms} f(t)e^{-jmw_o t}\,dt$

$$c_m = \frac{1}{T_O}\int_{-0.25ms}^{0.25ms} e^{-jmw_o t}\,dt$$

$$\int_{-0.25ms}^{0.25ms} e^{-jmw_o t}\,dt = \frac{1}{-jmw_o t}e^{-jmw_o t} + C$$

$$c_m = \frac{1}{T_O}\left(\frac{1}{-jmw_o t}\left[e^{-jmw_o(0.25ms)} - e^{-jmw_o(-0.25ms)}\right]\right)$$

$$e^{-jmw_o(0.25ms)} = e^{-jm\frac{\pi}{2}}, \qquad e^{-jmw_o(-0.25ms)} = e^{jm\frac{\pi}{2}}$$

$$e^{-jm\frac{\pi}{2}} - e^{jm\frac{\pi}{2}} = -2j\sin\left(\frac{m\pi}{2}\right)$$

$$c_m = \frac{1}{T_O}\left(\frac{1}{-jmw_o t}\left[-2j\sin\left(\frac{m\pi}{2}\right)\right]\right)$$

$$c_m = \frac{2}{mw_o T_O}\sin\left(\frac{m\pi}{2}\right)$$

$$c_m = \frac{2}{m(\frac{2\pi}{T_O})T_O}\sin\left(\frac{m\pi}{2}\right)$$

$$c_m = \frac{\sin\left(\frac{m\pi}{2}\right)}{\pi m}$$

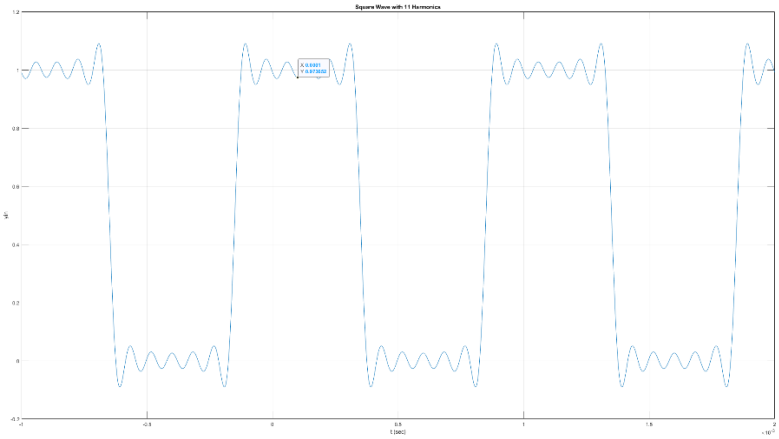
2) $c_o = \lim_{m\to 0}\frac{\sin\left(\frac{m\pi}{2}\right)}{\pi m}$

$$\frac{d}{d_m}\sin\left(\frac{m\pi}{2}\right) = \frac{\pi}{2}\cos(\frac{m\pi}{2})$$

$$c_o = \lim_{m\to 0}\frac{\frac{\pi}{2}\cos(\frac{m\pi}{2})}{\pi}$$

$$c_o = \frac{1}{2}\cos(0) = \frac{1}{2} * 1 = \frac{1}{2}$$

Section 3:



Section 1:

3) $C_1 = \frac{\sin(\frac{1\pi}{2})}{1\pi} = \frac{\sin(\frac{\pi}{2})}{\pi}$

$\sin(\frac{\pi}{2}) = 1$ $= \boxed{\frac{1}{\pi}}$

Section 3:

1) a. $c_m = \frac{1}{T_0}\left(\int_{-0.25ms+tp}^{0.25ms+tp} e^{-jm\omega_0 t}\,dt + \int_{0.25ms+tp}^{0.75ms+tp} 0\right)$

b. $c_m = \frac{1}{7E-3}\left(\frac{e^{jm\omega_0 t(0.25ms+tp)}}{-jm\omega_0 t} - \frac{e^{jm\omega_0 t(-0.25ms+tp)}}{-jm\omega_0 t}\right)$

d. $c_m = \frac{1}{-jm2\pi}\left(e^{jm2\pi(0.25)} - e^{-jm2\pi(0.25)}\right)e^{-jm\omega_0 tp}$

e. $c_m = \frac{1}{m\pi}\left(\frac{e^{jm\pi/2} - e^{-jm\pi/2}}{2j}\right)e^{-jm\omega_0 tp}$

f. $c_m = \frac{\sin(\pi m/2)}{\pi m}$ Figure 1

$c_m = \frac{\sin(\pi m/2)}{\pi m} e^{jm\omega_0 tp}$ Figure 4

The difference is the delay, which isn't included in Figure 1 but in Figure 4 represented by $e^{-jm\omega_0 tp}$

Signals Systems and Transforms
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Submissions:

Create your own cover page.
Submit your cover page, the requested solutions for sections 1 and 3, and this sign-off sheet.

Sign-offs

Name Jonathan Sumner

Section 2: Table 1, completed equation 3, square wave plot (figure 3), and stem plot (figure 2) with DC offset identified.

Signature	Date
	11 '04' 24