ECS 332: In-Class Exercise # 6

Instructions

1. Separate into groups of no more than three persons.
2. **The group cannot be the same as any of your former groups.**
3. Only one submission is needed for each group.
4. **Do not panic.**

Date: 18 / 10 / 2017			
Name	ID (last 3 digits)		
Prapun	5	5	5

1. Consider the rectangular pulse train $r(t)$ shown in Figure 1.

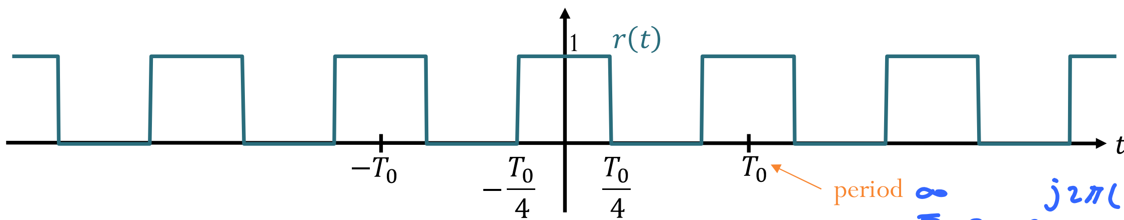

Figure 1

$r(t) = \sum_{k=-\infty}^{\infty} c_k e^{j2\pi(kf_0)t}$

a. Using Fourier series expansion, we can write $r(t)$ in the form

$$\cdots \boxed{\tfrac{-1}{3\pi}} e^{j2\pi(-3f_0)t} + \boxed{0} e^{j2\pi(-2f_0)t} + \boxed{\tfrac{1}{\pi}} e^{j2\pi(-f_0)t} + \underset{c_0}{\boxed{\tfrac{1}{2}}} + \underset{c_1}{\boxed{\tfrac{1}{\pi}}} e^{j2\pi(f_0)t} + \underset{c_2}{\boxed{0}} e^{j2\pi(2f_0)t} + \underset{c_3}{\boxed{\tfrac{-1}{3\pi}}} e^{j2\pi(3f_0)t} + \cdots$$

same

same

where $f_0 = \frac{1}{T_0}$.

Write the appropriate coefficients in the boxes above. same

$r(t) = c_0 + \sum_{k=1}^{\infty} a_k \cos(2\pi(kf_0)t)$

b. Using another form of Fourier series expansion, we can write $r(t)$ in the form

$$\underset{c_0}{\boxed{\tfrac{1}{2}}} + \underset{a_1}{\boxed{\tfrac{2}{\pi}}} \cos(2\pi(f_0)t) + \underset{a_2}{\boxed{0}} \cos(2\pi(2f_0)t) + \underset{a_3}{\boxed{\tfrac{-2}{3\pi}}} \cos(2\pi(3f_0)t) + \underset{a_4}{\boxed{0}} \cos(2\pi(4f_0)t) + \cdots$$

Write the appropriate coefficients in the boxes above.

2. Consider the rectangular pulse train $r(t)$ shown in Figure 2.

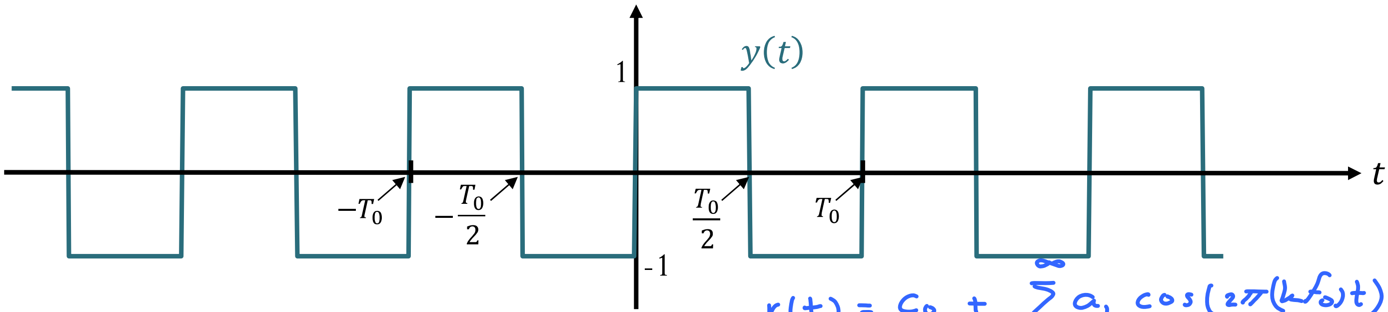

Figure 3

$r(t) = c_0 + \sum_{k=1}^{\infty} a_k \cos(2\pi(kf_0)t)$

a. Observe that $y(t) = \alpha + \beta r(t - \gamma T_0)$. Find the constants α, β, and γ.

$y(t) = \alpha + \beta r(t - \gamma T_0)$

α = <u>-1</u>, β = <u>2</u>, γ = <u>$\frac{1}{4}$</u>

$= (\alpha + \beta c_0) + \sum_{k=1}^{\infty} \beta a_k \cos\left(\underbrace{2\pi(kf_0)\left(t - \tfrac{T_0}{4}\right)}\right)$

$= 2\pi(kf_0)t$

$- \cancel{2}\pi k \cancel{f_0} \frac{\cancel{T_0}}{\cancel{4}_{2}}$

b. $y(t)$ can be written in the form

$$\boxed{0} + \boxed{\tfrac{4}{\pi}} \sin(2\pi(f_0)t) + \boxed{0} \sin(2\pi(2f_0)t) + \boxed{\tfrac{4}{3\pi}} \sin(2\pi(3f_0)t) + \boxed{0} \sin(2\pi(4f_0)t) + \cdots.$$

$\alpha + \beta c_0$

$= -1 + 2 \times \frac{1}{2}$

Write the appropriate coefficients in the boxes above.

$= \beta a_1 \cos\left(2\pi f_0 t - \frac{\pi}{2}\right)$

$= 2 \times \frac{2}{\pi} \times \sin(2\pi f_0 t)$

$= \beta a_3 \cos\left(2\pi(3f_0)t - 3\frac{\pi}{2}\right)$

$= 2 \times \left(\frac{-2}{3\pi}\right)\left(-\sin(2\pi(3f_0)t)\right)$