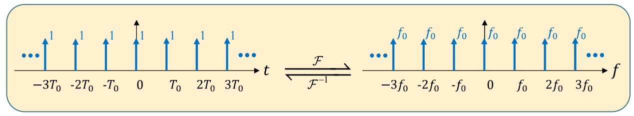
EES 351: In-Class Exercise # 12

Instructions

1. Work alone or in a group of no more than three students. **The group cannot be the same as any of your former groups after the midterm.**
2. **[ENRE] Explanation is not required for this exercise.**
3. Only one submission is needed for each group.
4. You have two choices for submission:
   (a) Online submission via Google Classroom
   - PDF only.
   - Only for those who can directly work on the posted files using devices with pen input.
   - Paper size should be the same as the posted file.
   - No scanned work, photos, or screen capture.
   - Your file name should start with the 10-digit student ID of one member. (You may add the IDs of other members, exercise #, or other information as well.)

   (b) Hardcopy submission
5. **Do not panic.**

Date: 16 / 10 / 2020			
Name	ID (last 3 digits)		



[4.47]

1. Consider the impulse train $g(t)$ shown on the left in Figure 1. Plot its Fourier transform $G(f)$ from $f=-1$ to $f=1$.

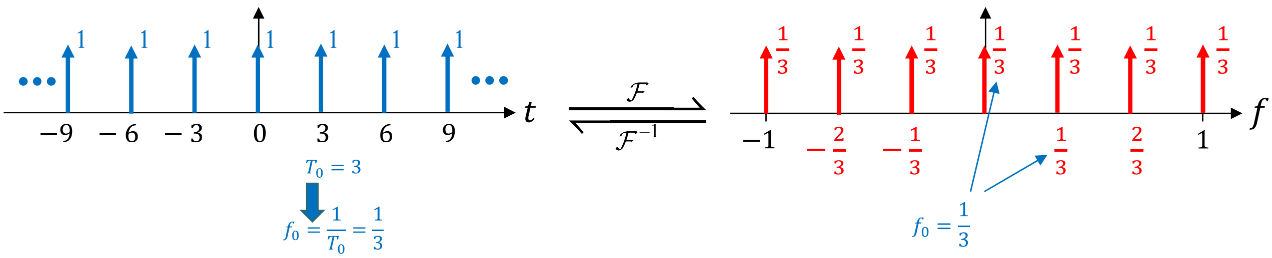
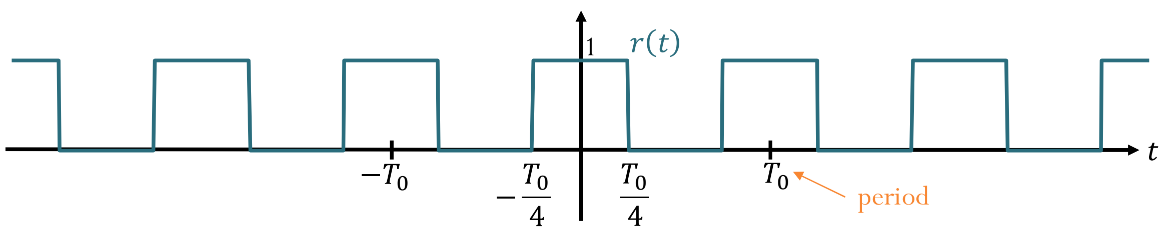


Figure 1

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



[4.53] $r(t) = \frac{1}{2} + \frac{2}{\pi}\cos(2\pi f_0 t) - \frac{2}{3\pi}\cos(2\pi(3f_0)t) + \frac{2}{5\pi}\cos(2\pi(5f_0)t) + \cdots$

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

$$\boxed{\tfrac{1}{2}} + \boxed{\tfrac{2}{\pi}}\cos(2\pi(f_0)t) + \boxed{0}\cos(2\pi(2f_0)t) + \boxed{-\tfrac{2}{3\pi}}\cos(2\pi(3f_0)t) + \boxed{0}\cos(2\pi(4f_0)t) + \cdots$$

where $f_0 = \frac{1}{T_0}$. Write the appropriate values of the constants in the boxes above.

3. Consider the periodic signal $y(t)$ shown in Figure 3.

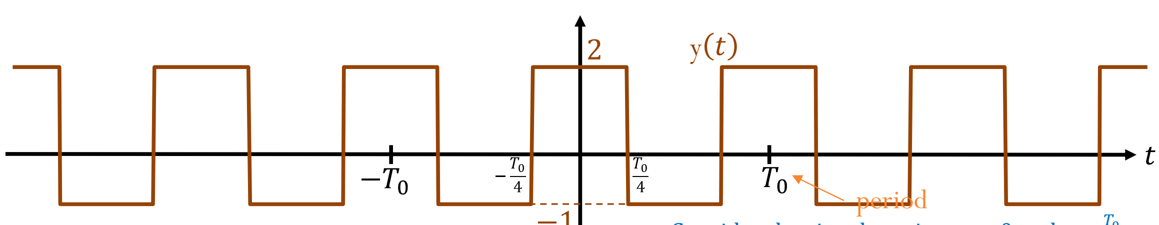


Figure 3

Consider the signals at time $t = 0$ and $t = \frac{T_0}{2}$.

@ $t = \frac{T_0}{2}$: $r(t) = 0$ and $y(t) = -1$.

Therefore, from $y(t) = \alpha + \beta r(t)$, we have $-1 = \alpha$.

Compare with Figure 2. Observe that $y(t) = \alpha + \beta r(t)$. Find the constants α and β.

@ $t = 0$: $r(t) = 1$ and $y(t) = 2$.

Therefore, from $y(t) = \alpha + \beta r(t)$, we have $2 = \alpha + \beta$; so $\beta = 3$.

$\alpha =$ <u>-1</u>, $\beta =$ <u>3</u>