

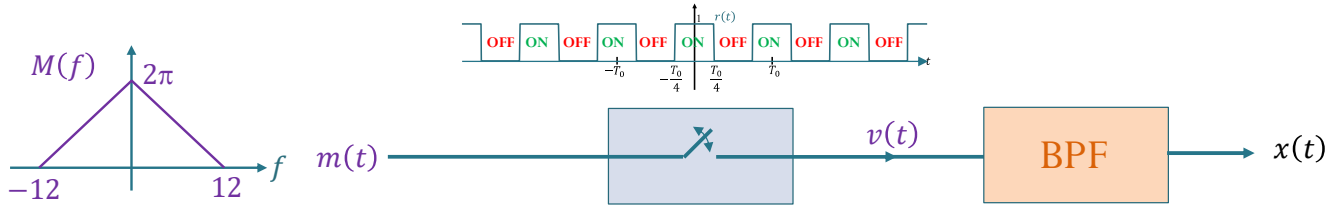
ECS 332: In-Class Exercise # 12 - Sol

Instructions

1. Separate into groups of no more than three students each. **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. **Do not panic.**

Date: <u>16</u> / <u>10</u> /2019			
Name	ID (last 3 digits)		
Prapun	5	5	5

1. $M(f)$ is plotted on the left below. Consider a switching modulator:

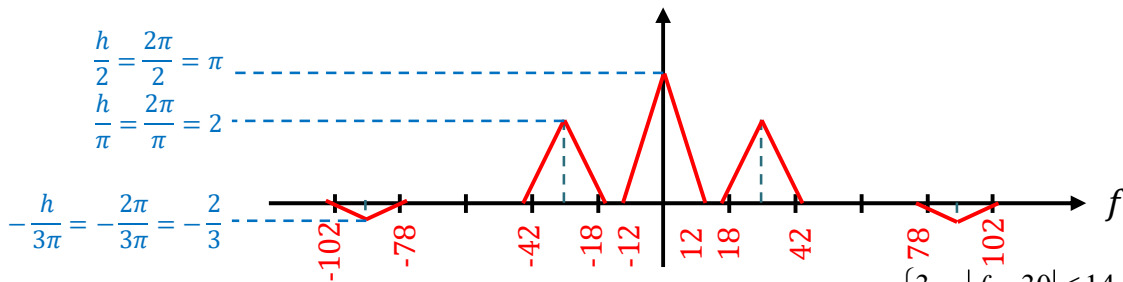


The switching box is operating at frequency 30 Hz with duty cycle 50%.

a. Plot $V(f)$

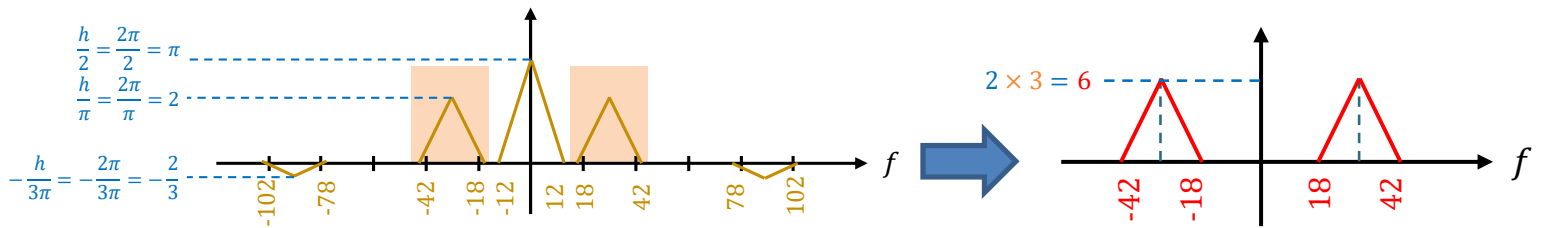
We have seen, in class, that

$$v(t) = m(t) \times r(t) \text{ where } r(t) = \frac{1}{2} + \frac{2}{\pi} \cos(2\pi f_0 t) - \frac{2}{3\pi} \cos(2\pi(3f_0)t) + \frac{2}{5\pi} \cos(2\pi(5f_0)t) + \dots$$



For the BPF, note that $|f - a| \leq b$ is the same as $-b \leq f - a \leq b$ which, in turn, is equivalent to $-b + a \leq f \leq b + a$.

b. Plot $X(f)$ when the frequency response of the BPF is $H(f) = \begin{cases} 3, & |f - 30| \leq 14, \\ 3, & |f + 30| \leq 14, \\ 0, & \text{otherwise.} \end{cases} = \begin{cases} 3, & 16 \leq f \leq 44, \\ 3, & -44 \leq f \leq -16, \\ 0, & \text{otherwise.} \end{cases}$



c. Plot $X(f)$ when the frequency response of the BPF is $H(f) = \begin{cases} 4, & |f - 33| \leq 3, \\ 4, & |f + 33| \leq 3, \\ 0, & \text{otherwise.} \end{cases} = \begin{cases} 4, & 30 \leq f \leq 36, \\ 4, & -36 \leq f \leq -30, \\ 0, & \text{otherwise.} \end{cases}$

