

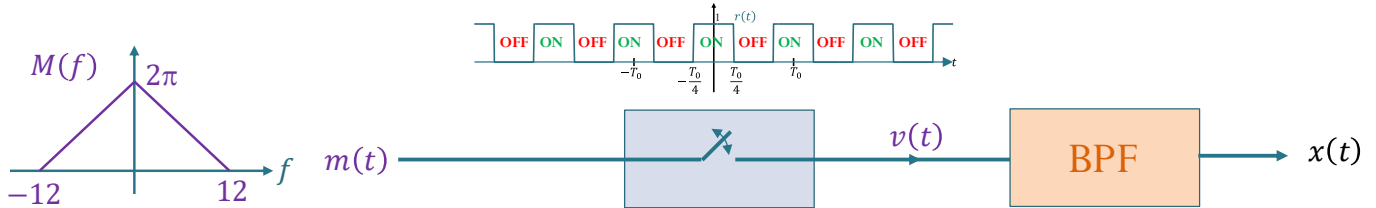
ECS 332: In-Class Exercise # 12 - Sol

Instructions

- 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.**
- [ENRE] Explanation is not required for this exercise.
- Do not panic.**

Date: <u>16</u> / <u>10</u> /2019			
Name			ID (last 3 digits)
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1. $M(f)$ is plotted on the left below. Consider a switching modulator:

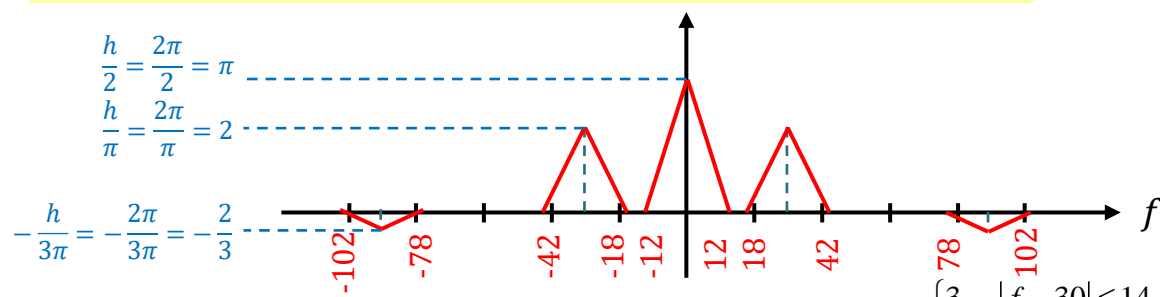


The switching box is operating at frequency 30 Hz with duty cycle 50%.

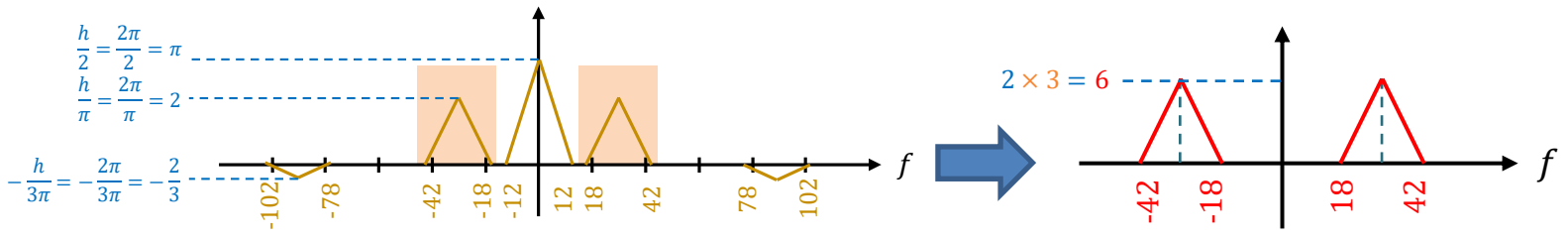
a. Plot $V(f)$

We have seen, in class, that
 $v(t) = m(t) \times r(t)$ 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 $H(f) = \begin{cases} 4, & |f - 33| \leq 3, \\ 4, & |f + 33| \leq 3, \\ 0, & \text{otherwise.} \end{cases} = \begin{cases} 4, & 30 \leq f \leq 36, \\ 4, & -36 \leq f \leq -30, \\ 0, & \text{otherwise.} \end{cases}$

