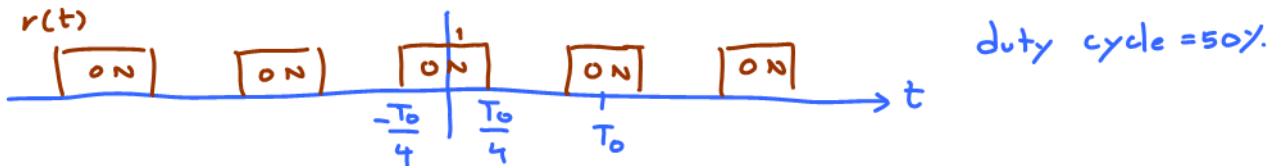
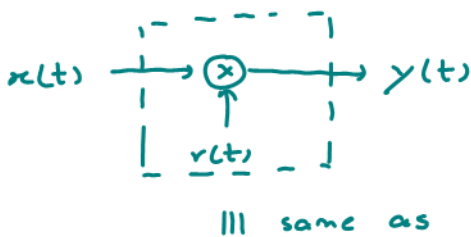


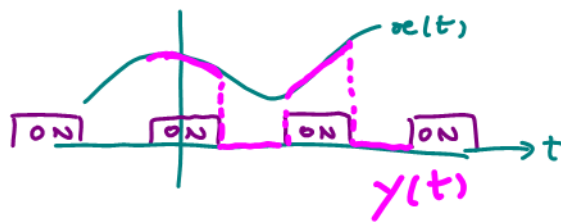
4.3 Fourier Series



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

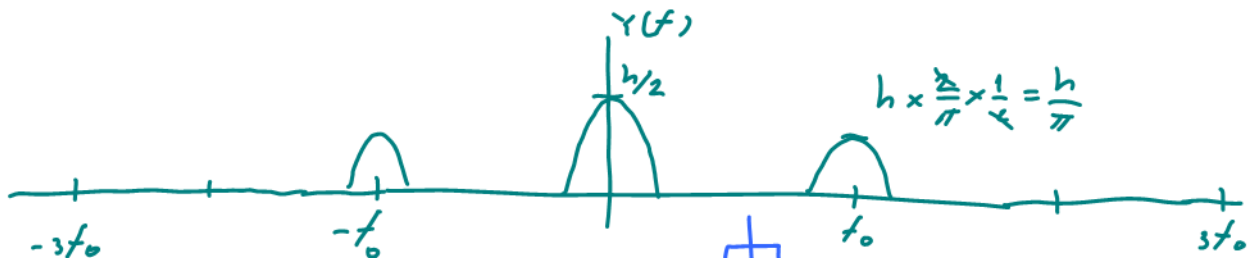


Time domain



Freq. domain

$$\begin{aligned} y(t) &= x(t) \times r(t) \\ &= x(t) \left( \frac{1}{2} + \frac{2}{\pi} \cos(2\pi f_0 t) - \dots \right) \\ &= \frac{1}{2} x(t) + \frac{2}{\pi} x(t) \cos(2\pi f_0 t) - \dots \end{aligned}$$



LTI device with freq response  $H(f)$   
 $\downarrow \mathcal{F}^{-1}$   
 impulse response  $h(t)$

LPF  $\leftarrow$   $H(f) = \begin{cases} g, & |f| < W, \\ 0, & \text{otherwise} \end{cases}$

BPF  $\leftarrow$   $H(f) = \begin{cases} g, & |f \pm f_c| < W, \\ 0, & \text{otherwise.} \end{cases}$

Time domain

$$x(t) \rightarrow [H(f)] \rightarrow y(t) = h(t) * x(t)$$

Freq. domain

$$Y(f) = X(f) H(f)$$





$$Y(f) = X(f) * X(f)$$

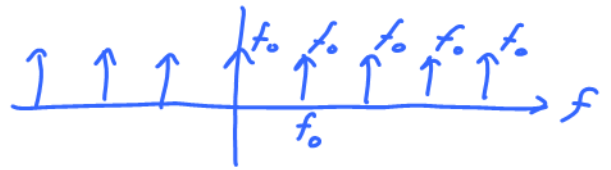


$$h(t) = \sum_i \rho_i \delta(t - \tau_i)$$

$$H(f) = \sum_i \rho_i e^{-j2\pi\tau_i f}$$



$\mathcal{F}$



$$x(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_0) = \sum_{k=-\infty}^{\infty} \frac{1}{T_0} e^{j2\pi(kf_0)t}$$

$$X(f) = \sum_{k=-\infty}^{\infty} f_0 \delta(f - kf_0)$$