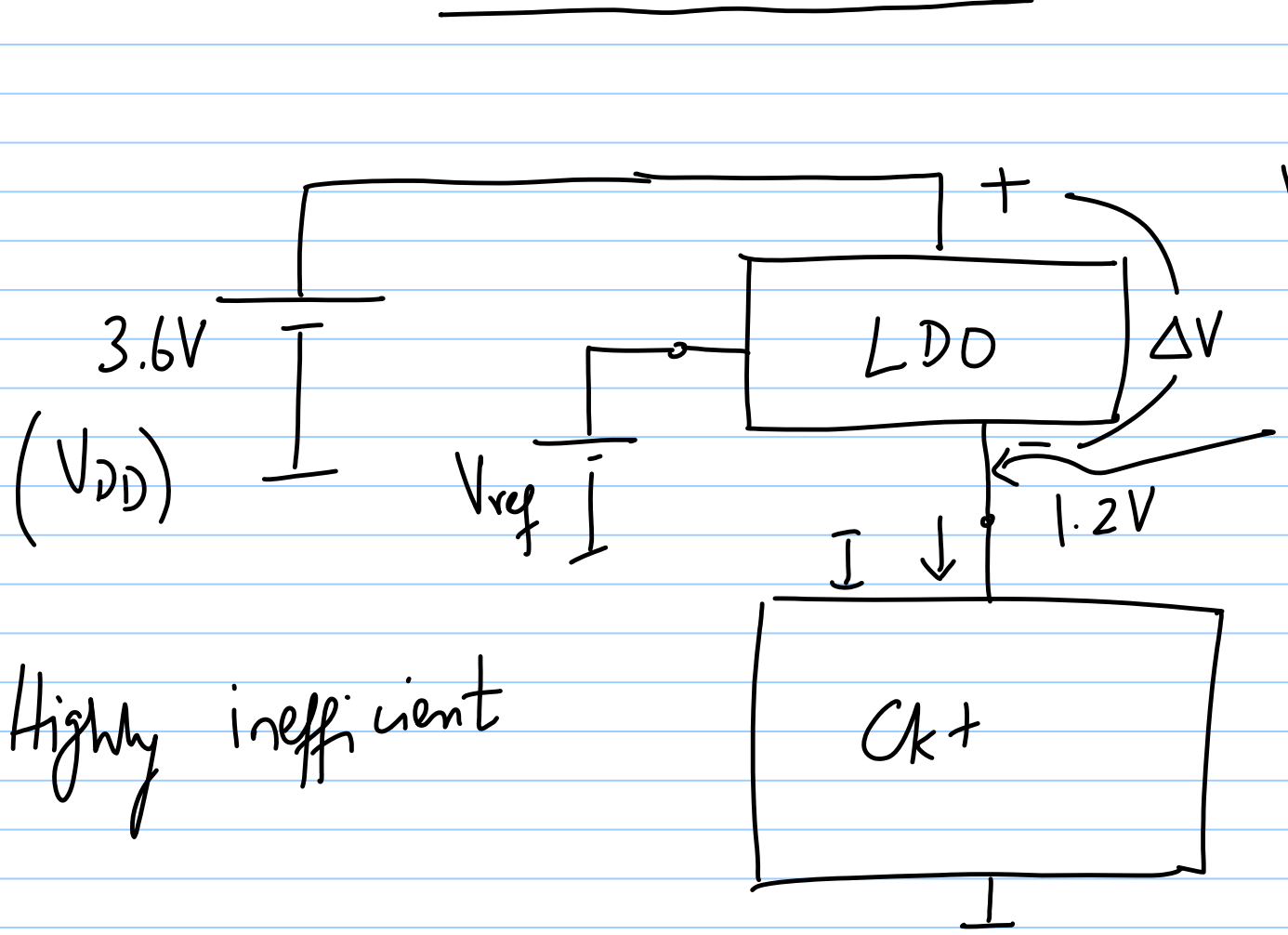
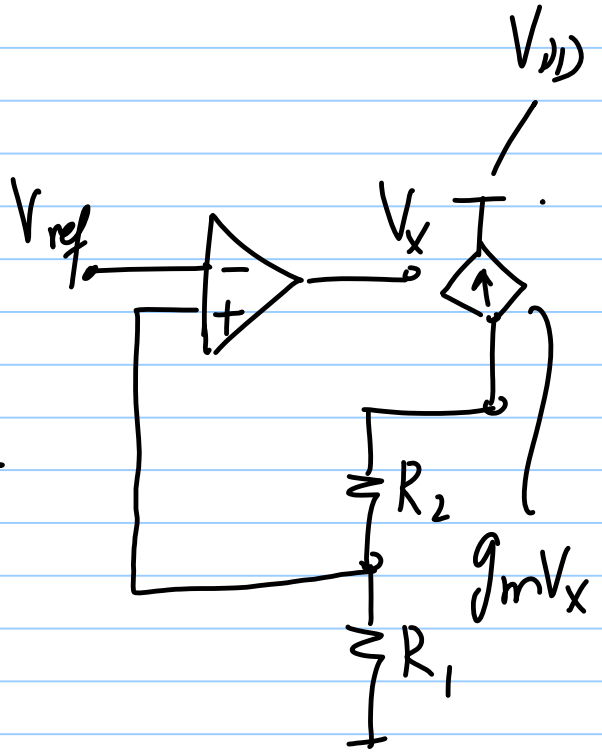
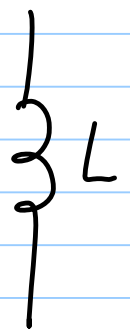
DC - DC converters

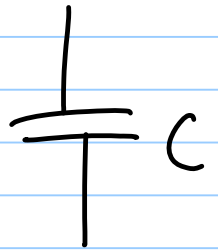


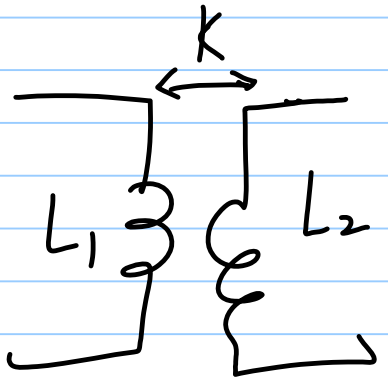


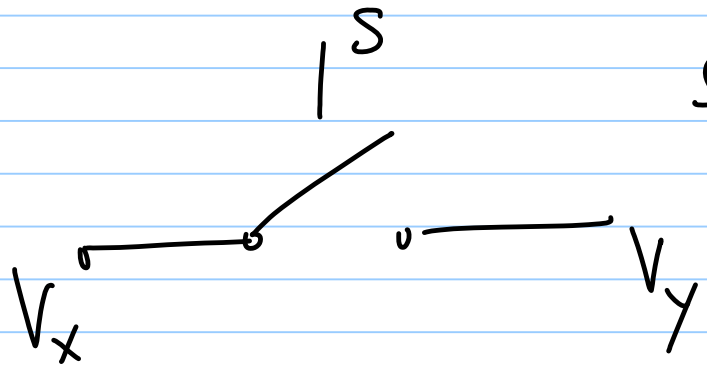
Highly inefficient

Lossless elements









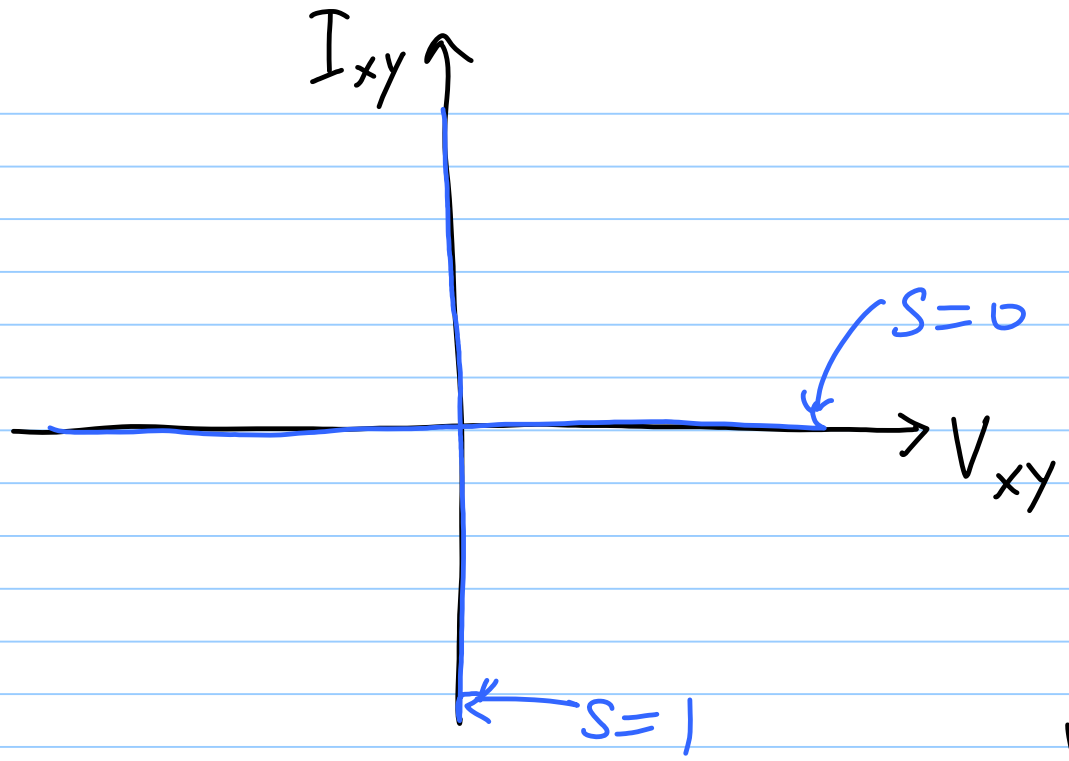
Switch

$S=1$: $V_x = V_y$

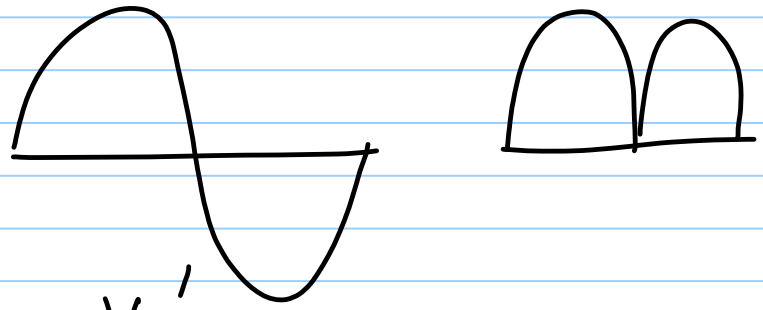
$P_{sw} = 0$

$S=0$: $I_{xy} = 0$

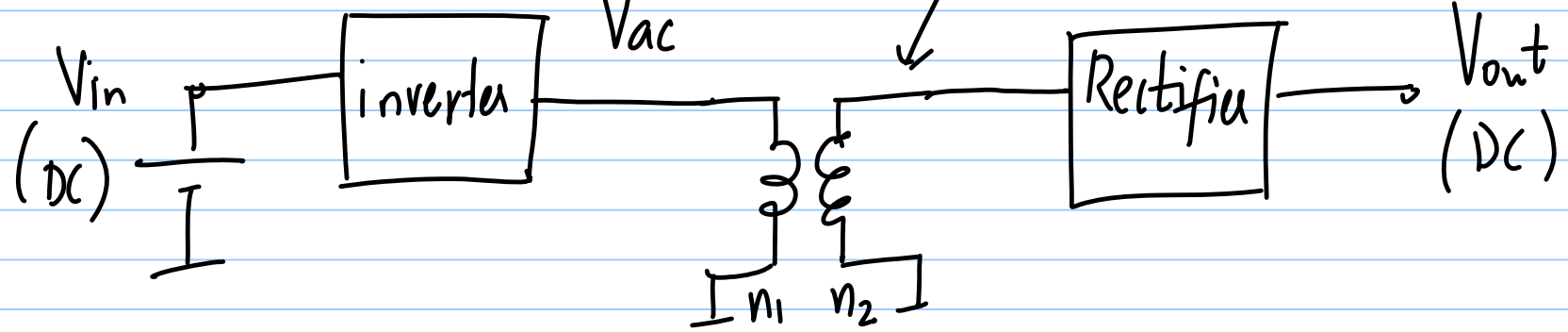
$P_{sw} = 0$

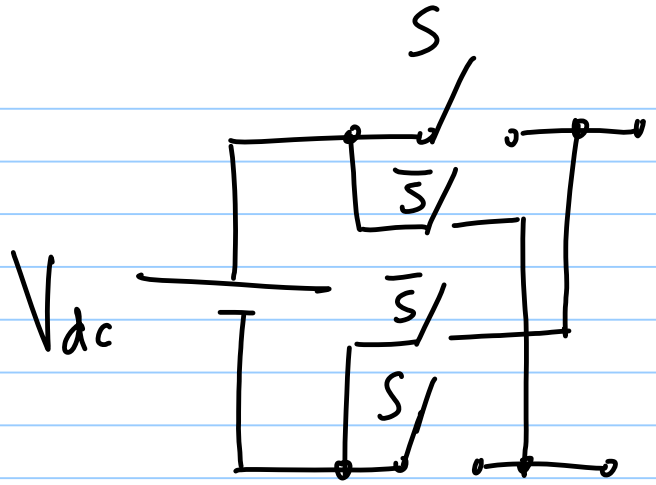


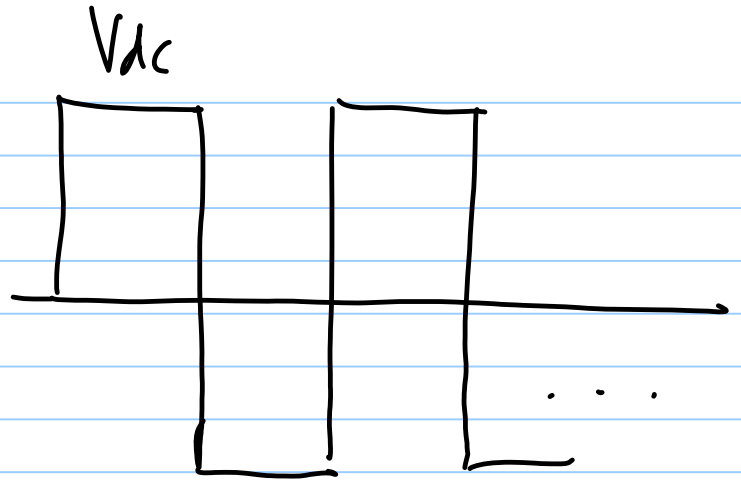
Switch is a "linear" element

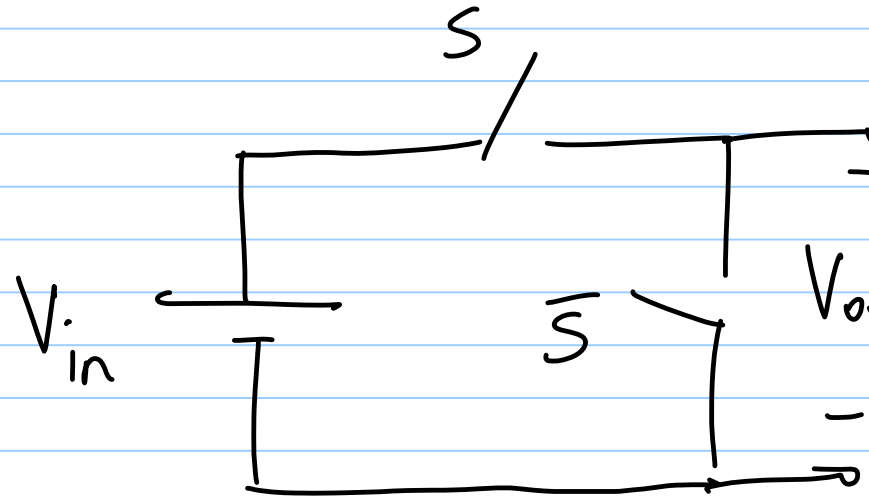


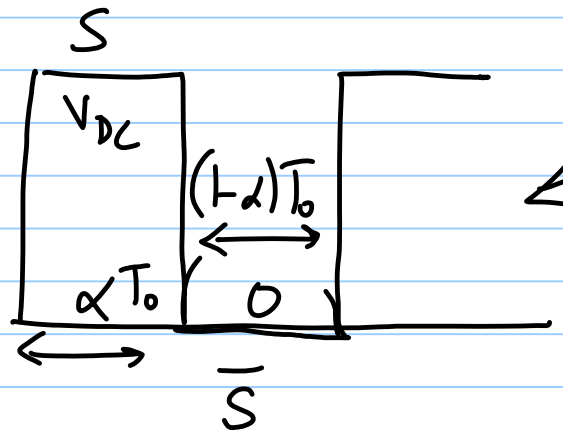
$V_{ac}' = \frac{V_{ac} \cdot n_2}{n_1}$











$V_0(x) = \frac{V_{in}}{2}$

change duty cycle to change V_{ODC}

$V_{o_{DC}}$ can be changed by varying duty cycle (α)

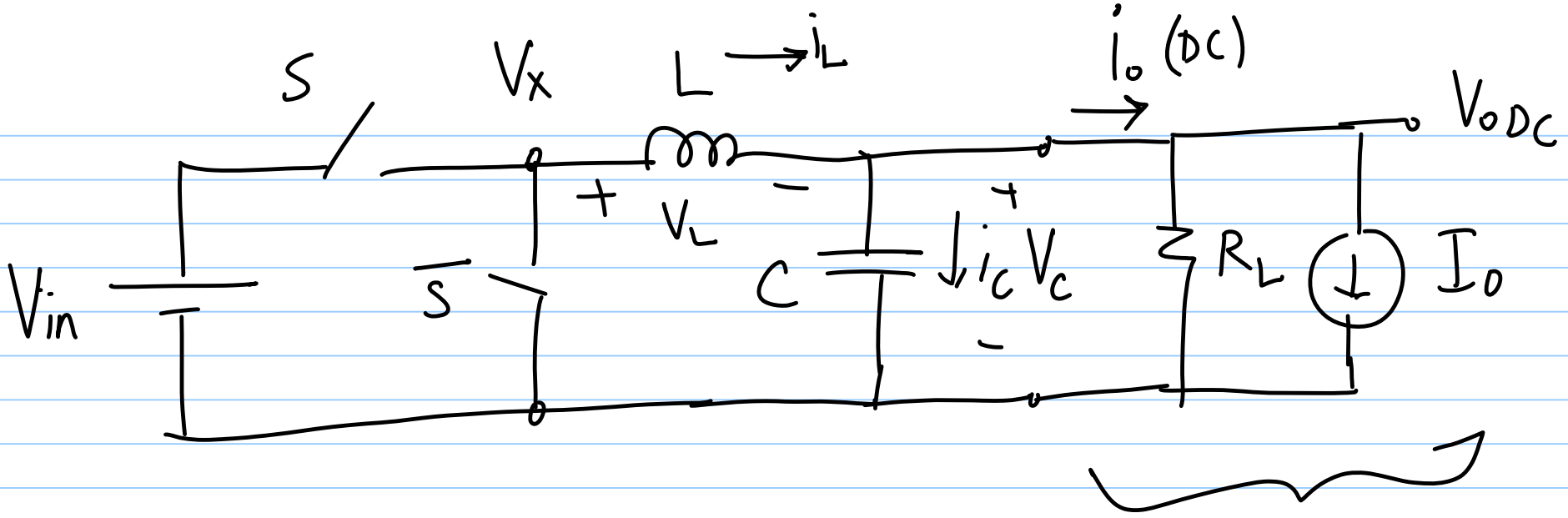
$V_{o_{DC}}$ can vary from 0 to V_{in}

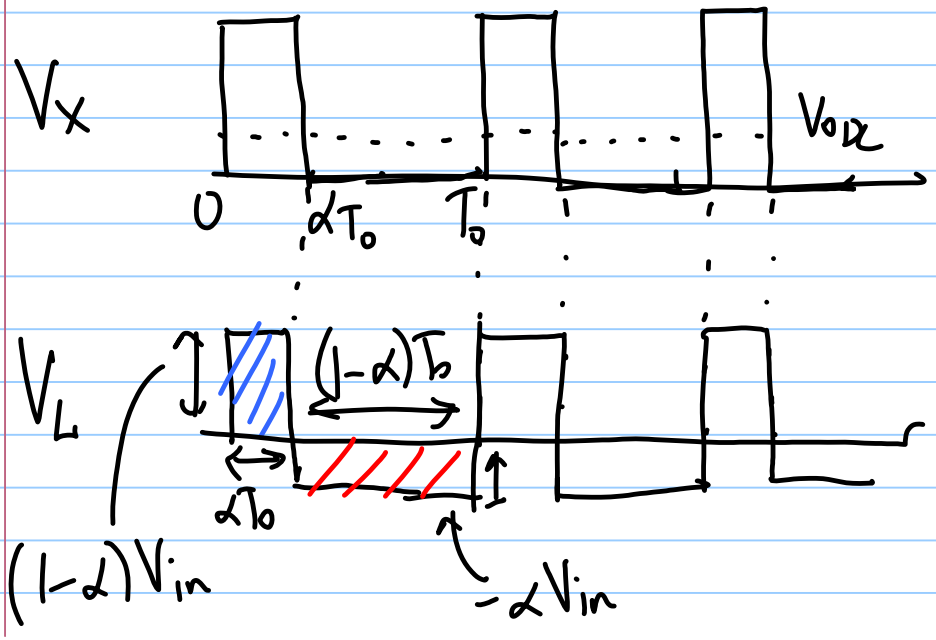
($\alpha = 0$) ($\alpha = 1$)

For a duty cycle α,

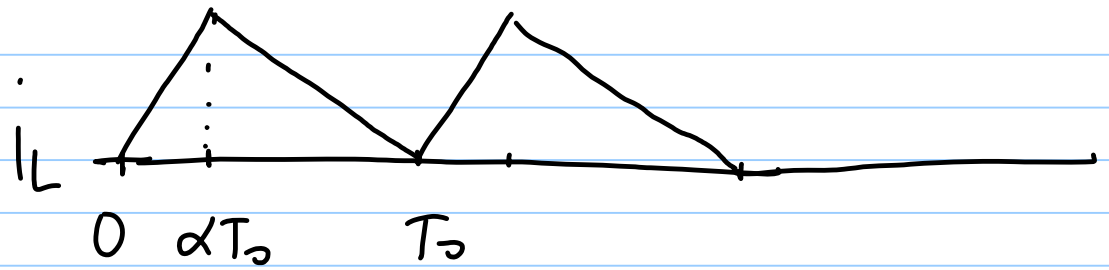
$$V_{o_{DC}} = \alpha V_{in}$$

$$V_{o_{ac}} = \sum_{k=\infty}^{\infty} V_k \cos(k\omega_0 t + \theta_k)$$ ← Filter out using LPF

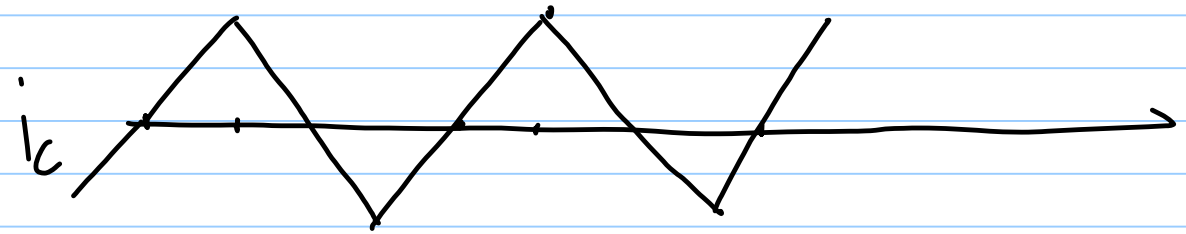




$$i_L = \frac{1}{L}\int V_L\,dt$$



$$i_{L\,pp} = \frac{\alpha(1-\alpha)V_{in}T_s}{L}$$



i_{pp}

$$V_c(t) = \frac{1}{C}\int i_c\,dt$$

HW

plot $V_c(t)$

αV_m