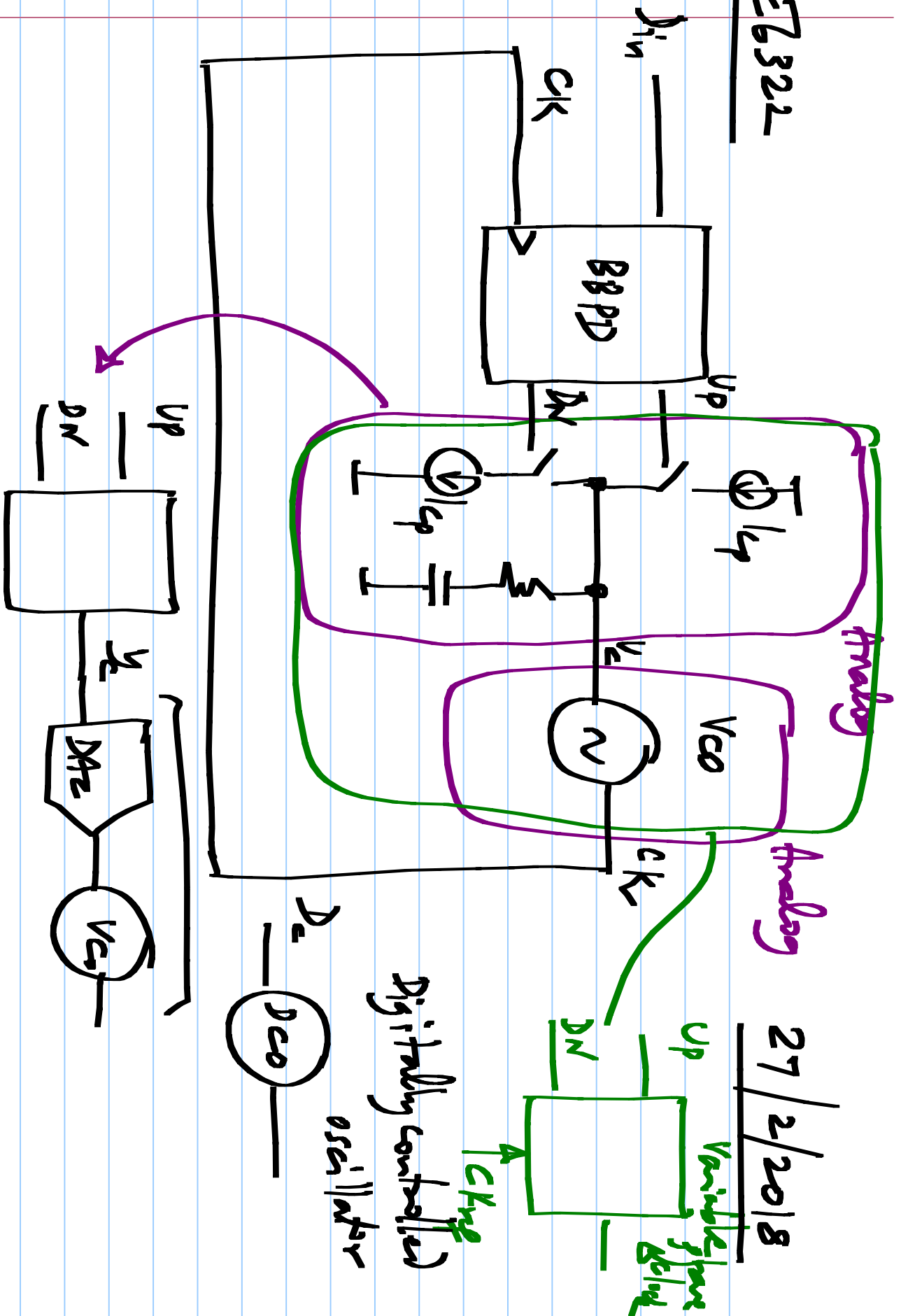
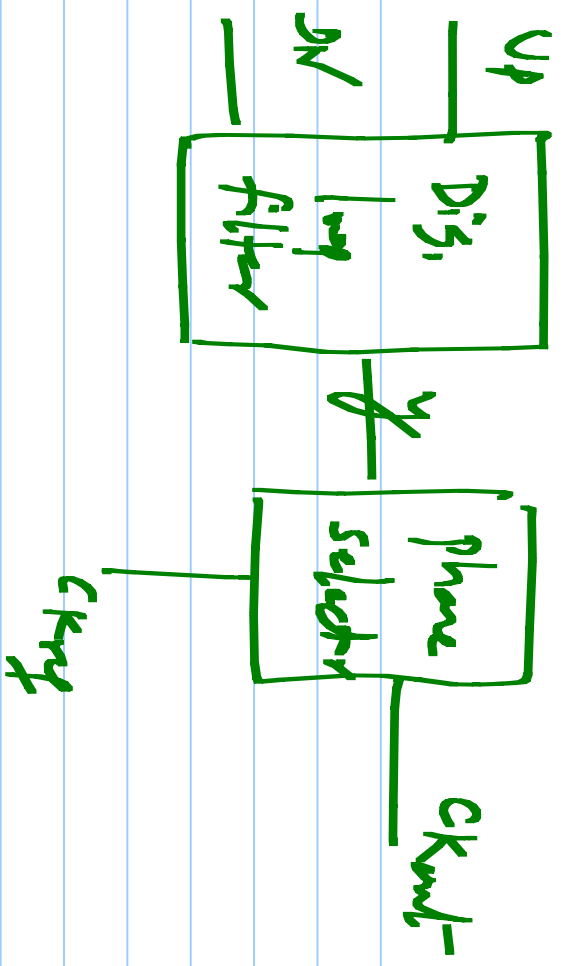


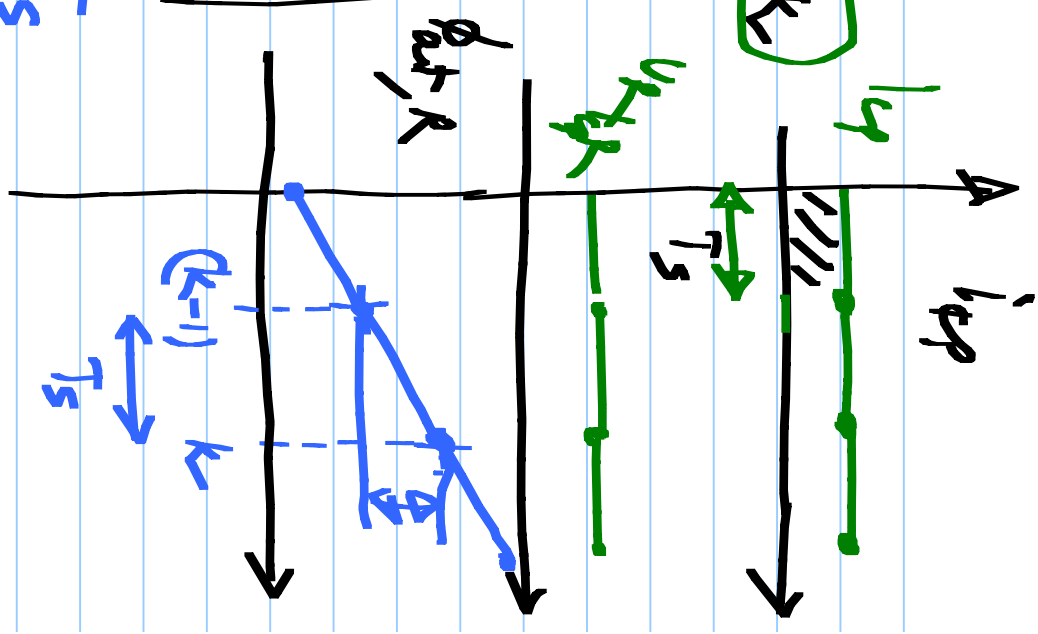
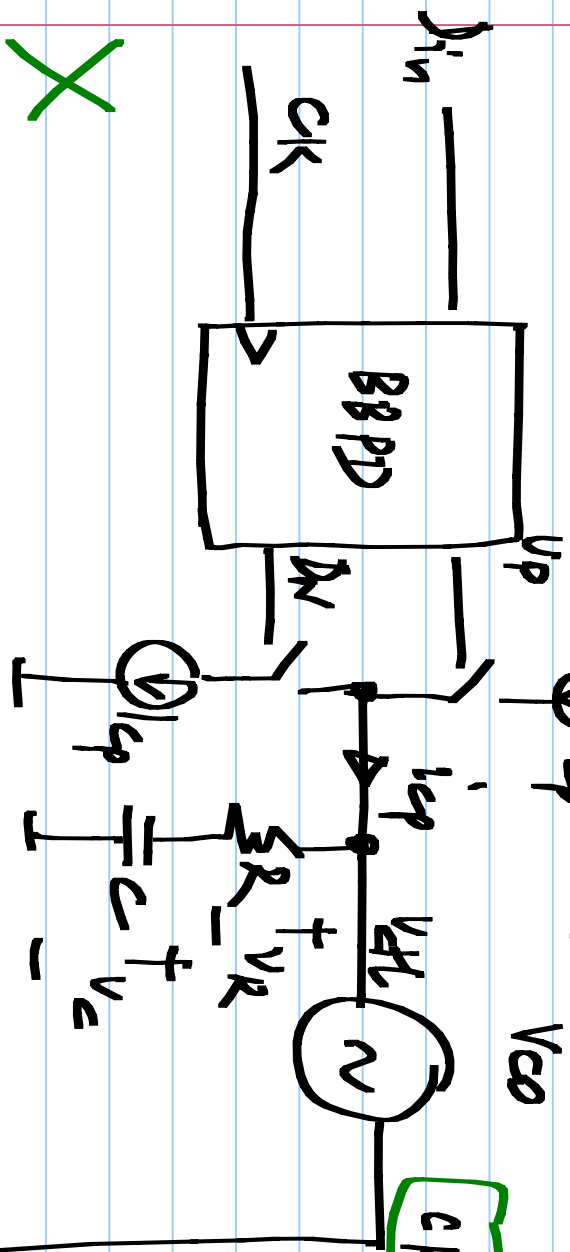
ECE 6322

27/2/2018



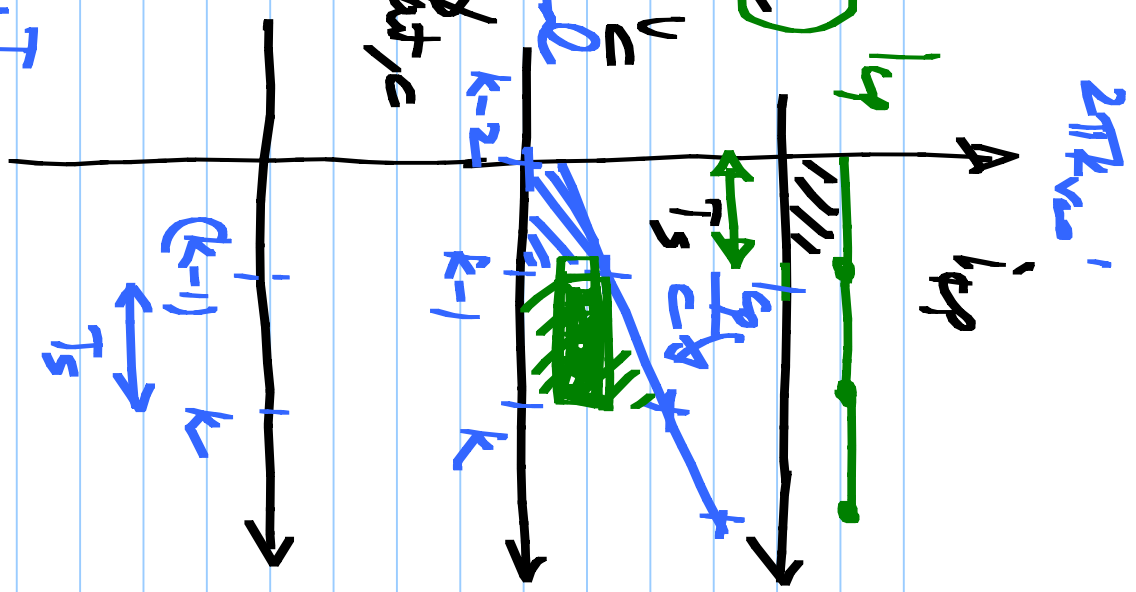
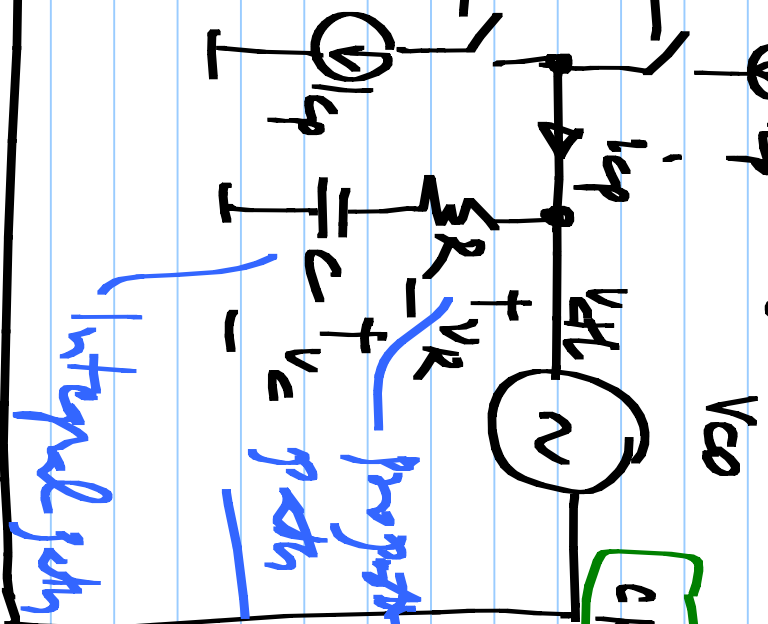
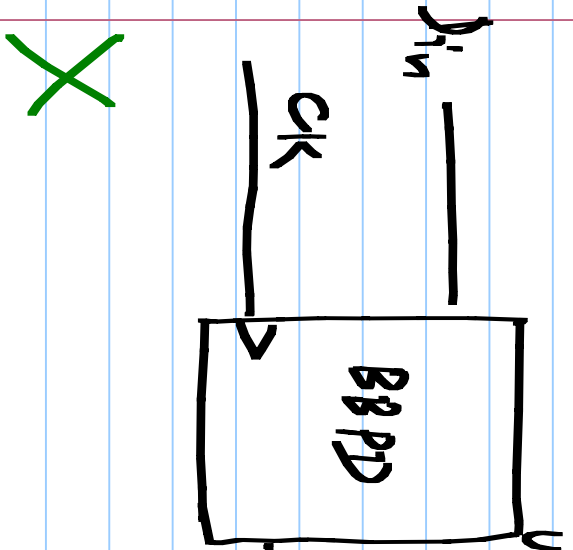


$$\phi_{out} = 2\pi K_{VCO} \int_{-\infty}^T V_{ctrl} \cdot dt$$



Due to V_R : $\phi_k - \phi_{k-1} = 2\pi K_{VCO} I_{cp} R \cdot T_s$

$$\phi_{out} = 2\pi K_{vco} \int_{-\infty}^T V_{ctrl} \cdot dt$$



$$\phi_k - \phi_{k-1} - (\phi_{k-1} - \phi_{k-2}) = 2\pi K_{vco} \cdot \frac{I_{cp} T_s}{C} \cdot T_s$$

$$y_k = u_k - D_N k : 0, \pm 1$$

Proportional path: $\phi_{k,R} - \phi_{k-1,R} = 2\pi k_{v0} \cdot |g_{i,R}| \cdot T_s \cdot y_k$

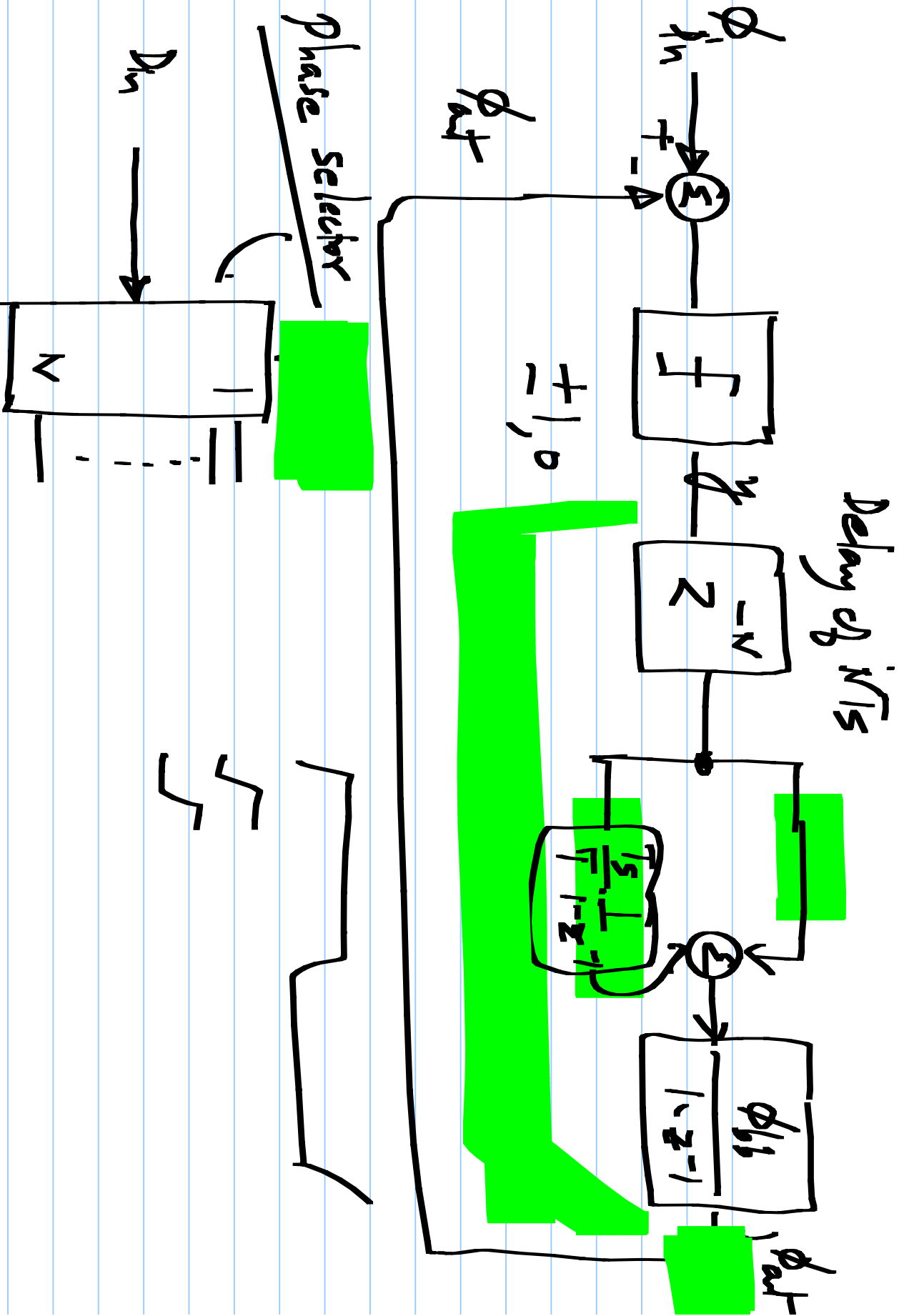
Integral path: $\phi_{k,C} - 2\phi_{k-1,C} + \phi_{k-2,C} = 2\pi k_{v0} \cdot \frac{R|g_{i,C}|}{CR} \cdot T_s \cdot y_k$

$$\phi_{out,R}(z) (1 - z^{-1}) = \underbrace{2\pi k_{v0} \cdot |g_{i,R}| \cdot T_s}_{A_{bL}} \cdot y(z)$$

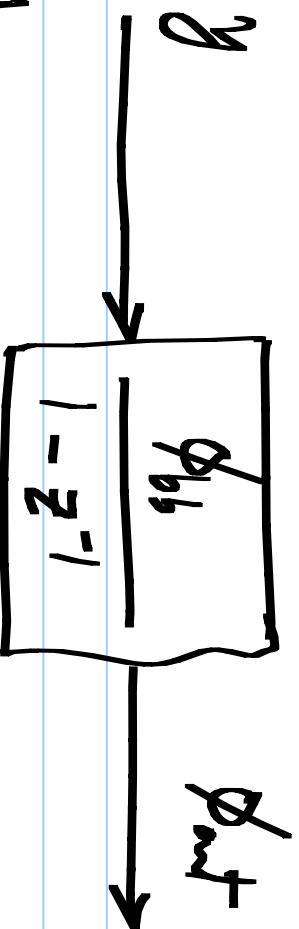
phase change over cycle due to an input

$$\phi_{out,R} = \phi_{b0} \cdot \frac{1}{1 - z^{-1}} \cdot y(z)$$

$$\phi_{out,C}(z) = \phi_{b0} \cdot \frac{T_s}{T_z} \cdot \frac{1}{(1 - z^{-1})^2} \cdot y(z)$$



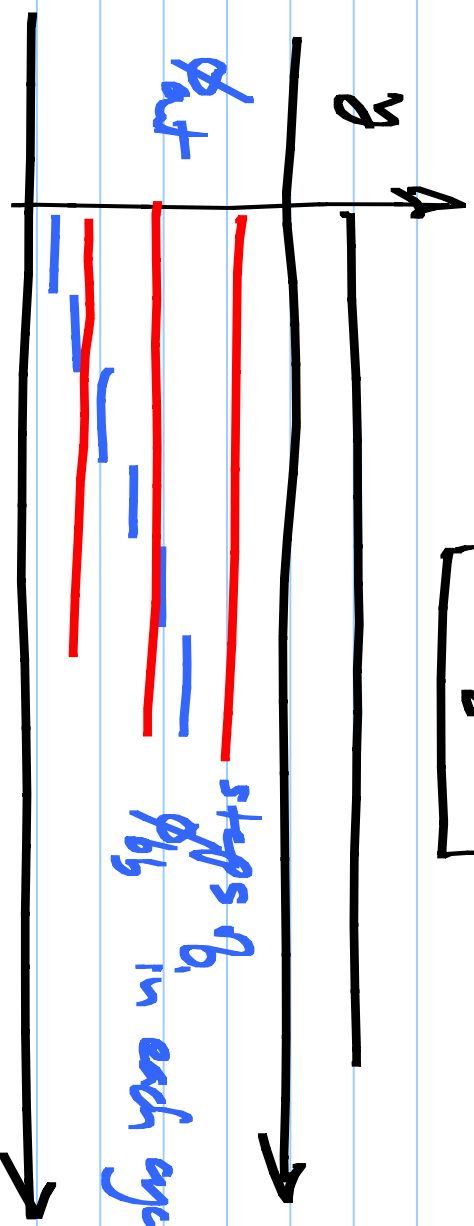
freq. path



$$\phi_b =$$

$$2\pi K_m \cdot \frac{1}{4} R \cdot T$$

$$2\pi \cdot 2\pi \cdot 10^4 \text{ Hz} \cdot \frac{1}{10^4 \text{ Hz}}$$



steps ϕ_b in each cycle

$$(4\pi^2) \cdot 10^{-3}$$

$$40 \cdot 10^{-3}$$

$$0.04 \text{ rad}$$