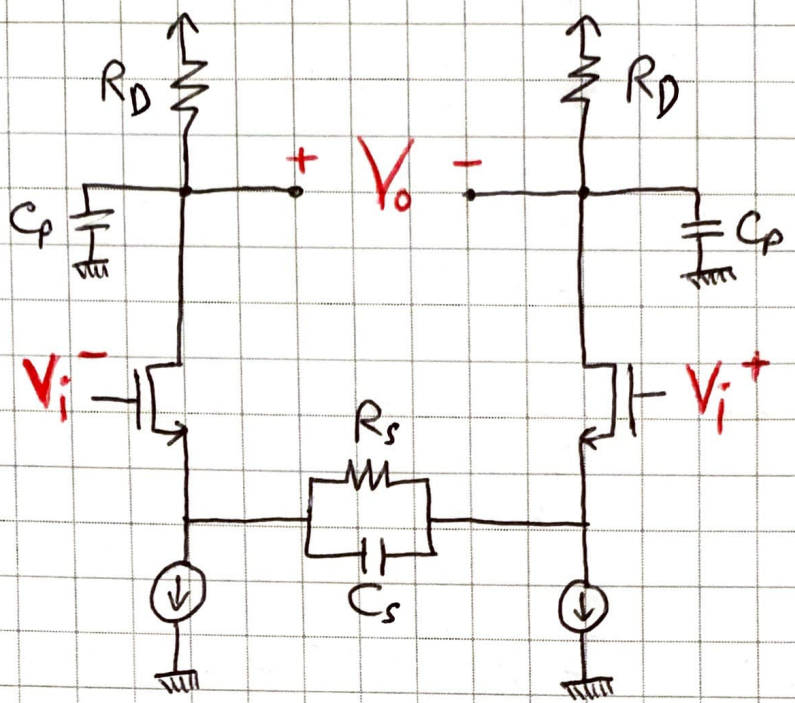
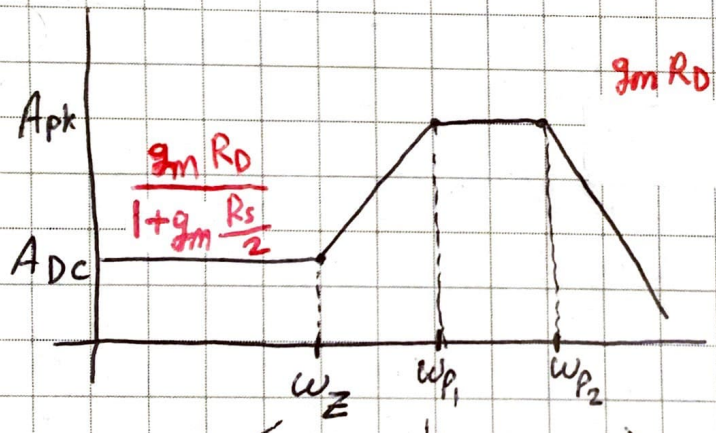
Active CTLE





$$\omega_z = \frac{1}{R_s C_s}$$

$$\omega_{p_1} = \frac{1 + g_m \frac{R_s}{2}}{R_s C_s}$$

$$\omega_{p_2} = \frac{1}{R_D C_p}$$

$$\text{peaking} = \frac{A_{pk}}{A_{DC}} = \frac{\omega_{p_1}}{\omega_z} = 1 + g_m \frac{R_s}{2}$$

Example:

Givens: Data-rate = 12Gb/s (NRZ)

$\therefore f_{Nyquist} = 6\,GHz$

$R_D = 400\,\Omega$, $C_p = 50\,fF$

$R_s = 1k\Omega$

Assume: Peaking = 10 dB (Target)

$f_{P_1} = \frac{2}{3} f_N$

$\Rightarrow$ for $f_{P_1} = \frac{2}{3} f_N$: $\omega_{P_1} = \frac{2}{3} \times 2\pi \times 6 = 8\pi$ G.rad/s

$\Rightarrow$ for peaking = 10 dB: ① $\frac{\omega_{P_1}}{\omega_z} = 10^{10/20}$

$\therefore \omega_z = 2.53\pi$ G.rad/s

$\therefore f_z = 1.26\,GHz = \frac{1}{R_s C_s} \rightsquigarrow \boxed{\therefore C_s = 126\,fF}$

② $\frac{A_{pk}}{A_{DC}} = 10^{10/20} = 1 + g_m \frac{R_s}{2}$

$\hookrightarrow \boxed{\therefore g_m = 4.32\,mS}$

$f_z = 1.26\,GHz$

$f_{P_1} = \frac{2}{3} f_N = 4\,GHz$

$f_{P_2} = \frac{1}{2\pi R_D C_p} \simeq 8\,GHz$