

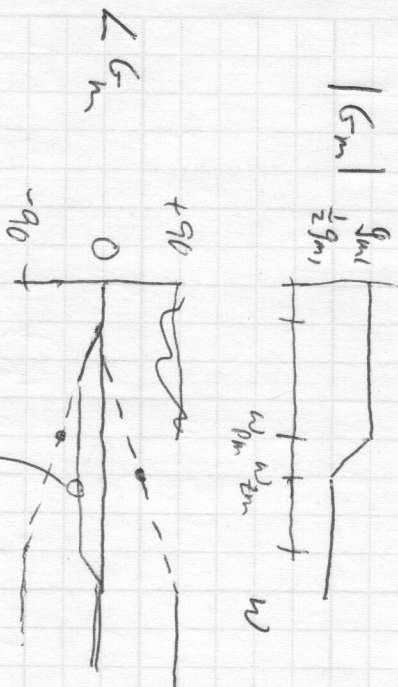
$$G_m = \frac{i_o}{v_i} \bigg|_{v_o=0}$$

$$i_o = i_{d1B} + i_{d2B}$$

$$g_{m2B} \frac{v_i}{2} \quad (\text{no change})$$

$$i'_{d2B} = \left(\frac{1}{1 + \frac{s}{\omega_{pm1}}} \right) i'_{d2A}$$

$$= \frac{1}{1 + \frac{s}{\omega_{pm}}} (g_{m2A} \frac{v_i}{2})$$



negative phase over
22 decades
max is -22°

$$i_o = \left(g_{m2B} + g_{m2A} \frac{1}{1 + \frac{s}{\omega_{pm}}} \right) \frac{v_i}{2}$$

$$G_m = \frac{g_{m2}}{2} \left(1 + \frac{1}{1 + \frac{s}{\omega_{pm}}} \right) = \frac{g_{m2}}{2} \left(\frac{1 + \frac{s}{\omega_{pm}} + 1}{1 + \frac{s}{\omega_{pm}}} \right)$$

$$= g_{m2} \left(\frac{1 + \frac{s}{\omega_{pm}}}{1 + \frac{s}{\omega_{pm}}} \right)$$

$$\omega_{pm} = 2 \omega_{pm}$$

RHP zero:



KCL @ \$v_o\$

$$s C_{gd} (v_o - v_i) + g_m v_i + \frac{1}{R_o} v_o + s C_2 v_o = 0$$

$$\left[\frac{1}{R_o} + s(C_2 + C_{gd}) \right] v_o = (-g_m + s C_{gd}) v_i$$

$$\frac{v_o}{v_i} = -g_m R_o \frac{1 + \frac{s}{\omega_z}}{1 + \frac{s}{\omega_p}}$$

$$\omega_z = \frac{g_m}{C_{gd}} \quad \text{RHP}$$

$$\omega_p = \frac{1}{R_o(C_2 + C_{gd})}$$

RHP zero for 2 stage: now we intentionally add C_c across C_{gd4} , so the zero that would otherwise be at very high frequency (and not a problem) is a real problem

$$\omega_{zc} = \frac{G_{m2}}{C_c} \quad \text{RHP}$$

So overall

$$\omega_{pic} = \frac{1}{R_{o1} G_{m2} R_{o2} C_c}$$

$$\omega_{uc} = \frac{G_{m1}}{C_c}$$

$$\omega_{p2} = \frac{G_{m2}}{C_1 + C_2 + \frac{C_1 C_2}{C_c}}$$

$$\omega_{zc} = \frac{G_{m2}}{C_c}$$

$$\omega_{pm} = \frac{G_{m2}}{2 C_{gs2}}$$

$$\omega_{zm} = 2 \omega_{pm} \quad \text{(little } g_{m2})$$

$$\text{RHP (b/s } G_{m2})$$