

Frequency response

p. 745

Eq. (7.189)

$$i_o = \left(\frac{g_m}{1 + A \frac{g_{m3}}{C_m}} + g_m \right) \frac{v_{id}}{2}$$

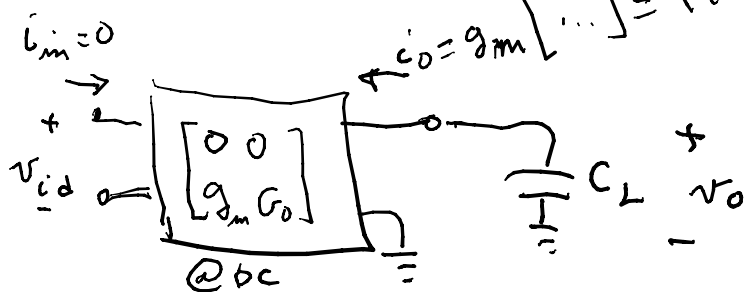
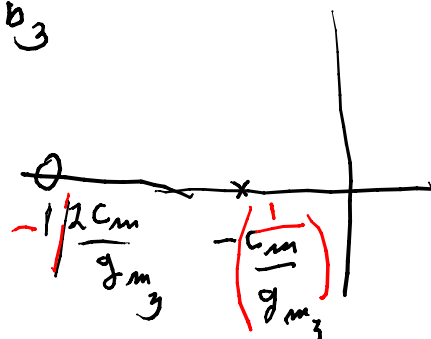
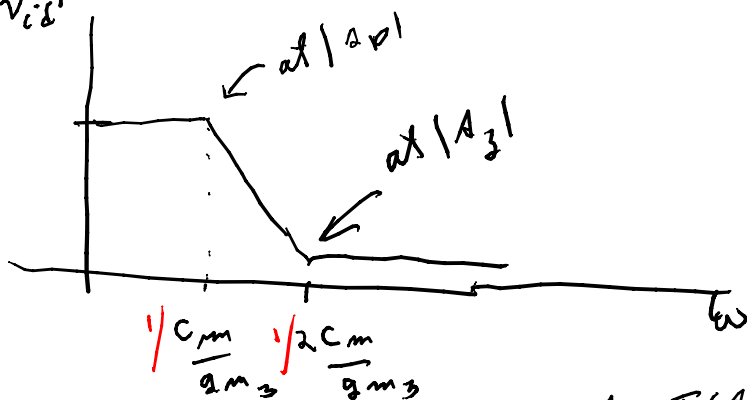
$$= \frac{g_m}{2} \left[\frac{2 + A \frac{g_{m3}}{C_m}}{1 + A \frac{g_{m3}}{C_m}} \right] v_{id} = T(\omega) v_{id}$$

$$C_m = C_{gd1} + C_{gs3} + C_{gs4} + C_{db1} + C_{db3}$$

Asplme

pole @ $A_p = -\frac{1/2 C_m}{g_{m3}}$, $A_z = -\frac{1/2 C_m}{g_{m3}}$

$$20 \log_{10} \left| \frac{i_o}{v_{id}} \right|$$



$$g_{21} = \left. \frac{i_{out}}{v_{in}} \right|_{v_{out}=0} = T(\omega)$$

$$Y(s) = \begin{bmatrix} 0 & 0 \\ T(s) & G_o + sC_{out} \end{bmatrix} \quad \text{assume } C_{out} = 0$$

when load with C_L , $v_{out} = -i_o \times \frac{1}{sC_L}$

$$i_o = T(s)v_{in} + G_o \cdot v_{out}$$

$$= T(s)v_{in} - G_o \frac{1}{sC_L} i_o \Rightarrow i_o \left[1 + \frac{G_o}{sC_L} \right] = T(s)v_{id}$$

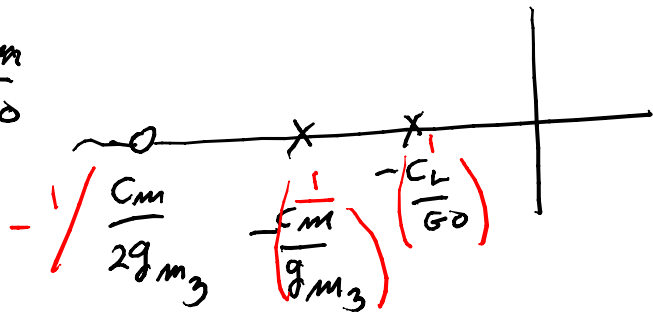
$$v_o = -\frac{1}{sC_L} i_o \Rightarrow v_o \left(-sC_L \left[1 + \frac{G_o}{sC_L} \right] \right) = T(s)v_{id}$$

$$\frac{v_o}{v_{id}} = \frac{-T(s)}{sC_L + G_o} = \frac{-\frac{g_m}{2} \left[2 + s \frac{C_m}{g_{m3}} \right]}{\left(\frac{sC_L}{G_o} + 1 \right) \left(1 + s \frac{C_m}{G_o} \right)} \times \frac{1}{G_o}$$

$$= \text{Eq (7.191)} = -R_o g_m \left[\frac{1 + \frac{sC_m}{2g_{m3}}}{\left(1 + s \frac{C_m}{g_{m3}} \right) \left(1 + s \frac{C_L}{G_o} \right)} \right]$$

at $s=0$

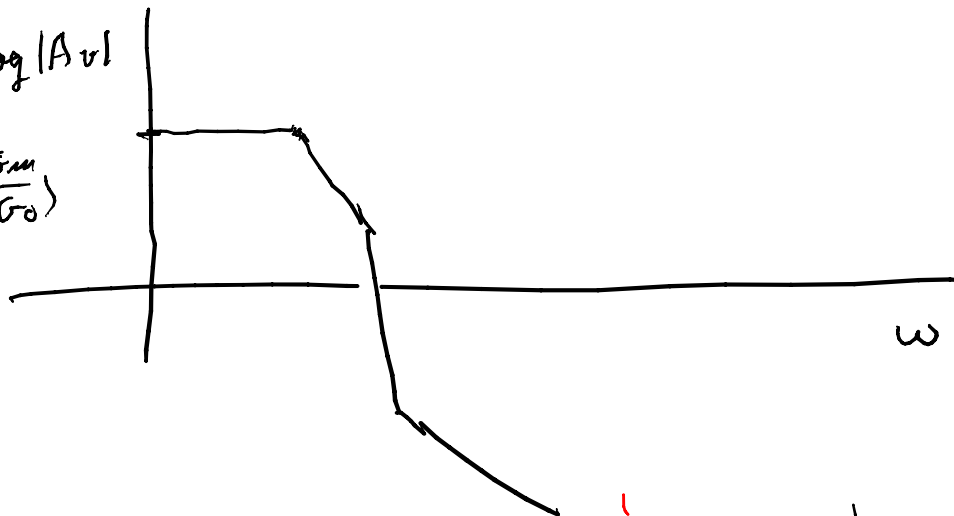
$$\frac{v_o}{v_{id}} = -R_o g_m = -\frac{G_m}{G_o}$$



$$\left| \frac{v_o}{v_{id}} \right| = |A_v|$$

use $20 \log |A_v|$

$$20 \log_{10} \left(\frac{g_m}{G_o} \right)$$



if $C_L < C_m$ & $g_m \approx G_o$

