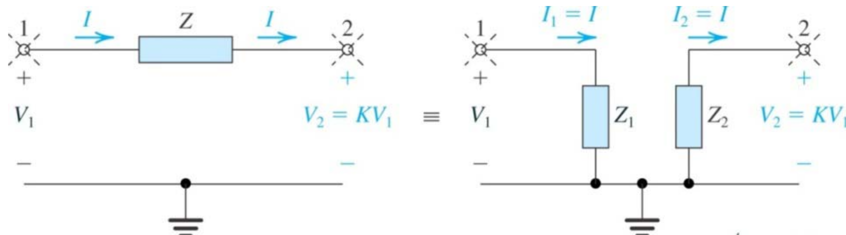
MILLLER'S THEOREM



$Z_1 = Z/(1-K), \quad Z_2 = Z\Big/\left(1-\frac{1}{K}\right)$

$$K = \frac{V_o}{V_{gs}} = -g_m R_L' ; \qquad C_1 = C_{gd}\left(1-K\right) = C_{gd}\left(1+g_m R_L'\right); \qquad C_2 = C_{gd}\left(1-\frac{1}{K}\right) = C_{gd}\left(1+\frac{1}{g_m R_L'}\right)$$

FET EQUATIONS

$$I_D = \frac{1}{2}k_n' \frac{W}{L}\left(v_{GS1} - V_t\right)^2 = \frac{1}{2}k_n'\frac{W}{L}V_{OV}^2 ; \qquad f_T = \frac{g_m}{2\pi\left(C_{gs}+C_{gd}\right)} ; \; g_m = \frac{2I_D}{V_{OV}} ; \qquad r_o = \frac{|V_A|}{I_D}$$

BJT EQUATIONS

$$I_C = I_S e^{-v_{BE}/V_T} ; \qquad \alpha = \beta\big/\left(\beta+1\right) ; \qquad I_C = \alpha I_E ; \qquad v_{BE2} = v_{BE1} + V_T \ln\left(\frac{i_{C2}}{i_{C1}}\right)$$

$$g_m = \frac{I_C}{V_T} ; \qquad r_\pi = \frac{\beta}{g_m} ; \qquad r_e = \frac{V_T}{I_E} ; \qquad r_o = \frac{V_A}{I_C}; \; f_T = \frac{g_m}{2\pi\left(C_\pi + C_\mu\right)}; \; f_\beta = \frac{1}{2\pi\left(C_\pi + C_\mu\right)r_\pi} = \frac{f_T}{\beta_0}$$

MISCELLANEOUS EQUATIONS

$$f_H = \frac{1}{\sqrt{\frac{1}{f_{Pi}^2} + \frac{1}{f_{Po}^2} - \frac{2}{f_Z}}}$$

OPEN CIRCUIT TIME CONSTANTS

Determining R_{gd}

$$I_x = -V_{gs}\left(R_G \,||\, R_{sig}\right) = -V_{gs}R_{sig}' \Rightarrow V_{gs} = -I_x R_{sig}'$$

$$I_x = g_m\left(-I_x R_{sig}'\right) + \frac{\left(-I_x R_{sig}'\right)+V_x}{R_L'} = \frac{-I_x g_m R_{sig}' R_L'}{R_L'} + \frac{V_x - I_x R_{sig}'}{R_L'}$$

$$I_x R_L' = -I_x g_m R_{sig}' R_L' - I_x R_{sig}' + V_x \Rightarrow V_x = I_x R_L' + I_x g_m R_{sig}' R_L' + I_x R_{sig}'$$

$$R_{gd} \equiv \frac{V_x}{I_x} = R_L' + g_m R_{sig}' R_L' + R_{sig}'$$

$$= R_{sig}'\left(1+g_m R_L'\right) + R_L'$$