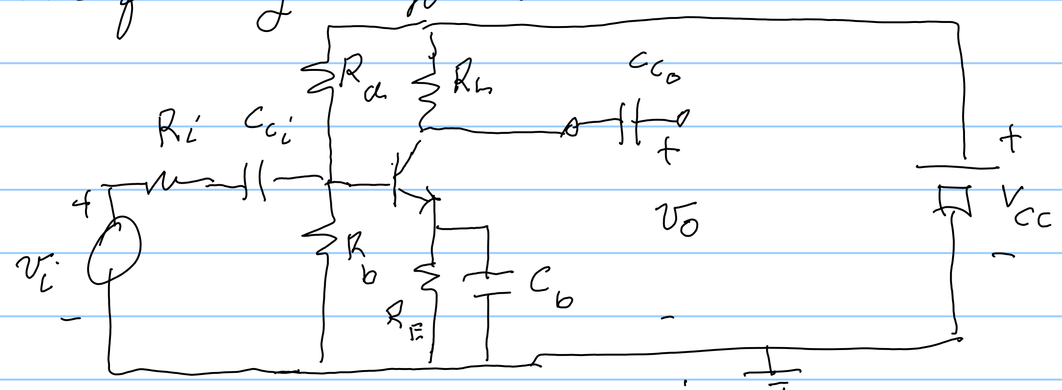
Note Title 10/8/2015

EE 303H

10/08/15

TI EZ430 look up on web (watches)

Frequency response

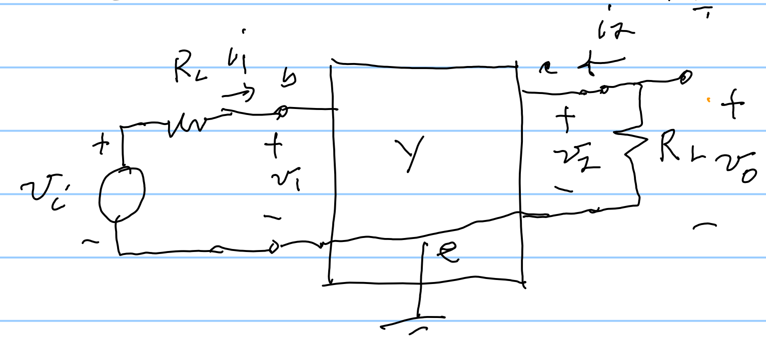


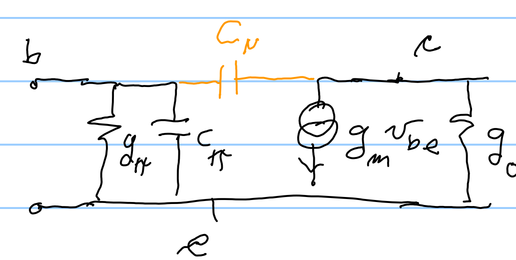
$$z_c = \frac{1}{sC} \Big|_{s = j\omega} = \frac{1}{j\omega}$$

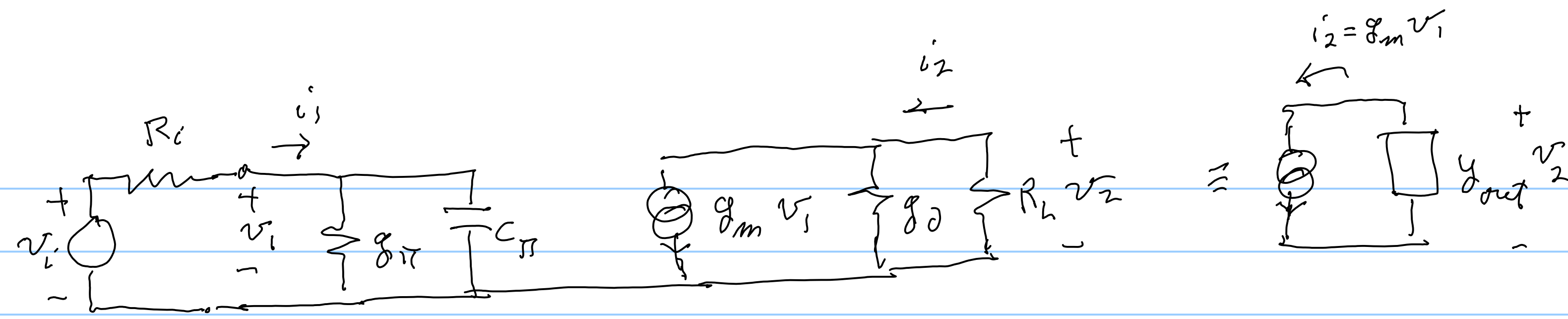
$$|z_c(j\omega)| = \frac{1}{|\omega|} \to 0 \text{ at } \omega \to \infty$$

$$\infty \text{ at } \omega \to 0$$

$$\text{" DC bias}$$







$$v_1 = v_i \times \frac{\frac{1}{y_\pi}}{R_i + \frac{1}{y_\pi}} \qquad y_\pi = g_\pi + s C_\pi$$

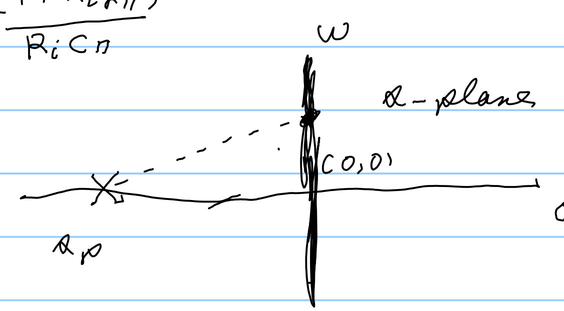
$$= v_i \cdot \frac{1}{1 + R_i y_\pi} \implies g_m v_1 = \frac{g_m}{1 + R_i y_\pi} v_i$$

$$v_2 = (-g_m v_1) \times \frac{1}{g_o + G_L} = \frac{-g_m}{1 + R_i(g_\pi + s C_\pi)} \cdot \frac{R_L}{g_o R_L + 1} v_i \quad ; \; R_L' = \frac{R_L}{1 + R_L g_o}$$

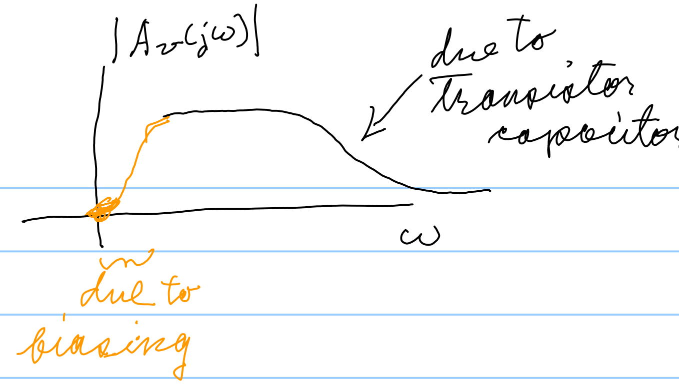
$$\frac{v_{out}}{v_{in}}(s) = \frac{-g_m R_L'}{R_i C_\pi s + 1 + R_i g_\pi} = \frac{-g_m R_L' / (R_i C_\pi)}{s + \frac{(1 + R_i g_\pi)}{R_i C_\pi}} \quad ; \; s = \sigma + j\omega$$

pole is @ $s_p = -\left(\frac{1 + R_i g_\pi}{R_i C_\pi}\right)$

$$A_v(s) = \left.\frac{v_{out}}{v_{in}}(s)\right|_{s = j\omega} = \frac{-A}{s - s_p}$$



$$|A_v(j\omega)| = \frac{|A|}{|j\omega - s_p|} = \frac{A}{\sqrt{(-s_p)^2 + \omega^2}}$$

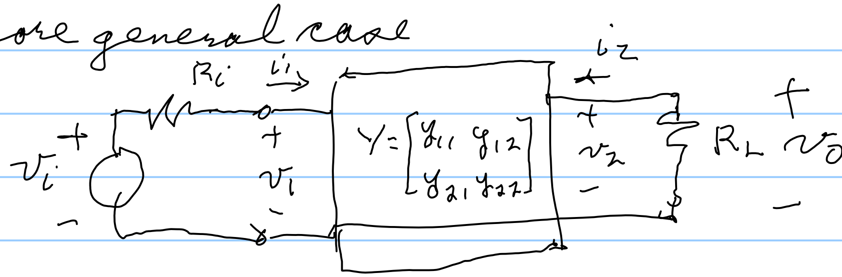


if include C_μ
then get

$$A_v(s) = \frac{as + b}{s^2 + \frac{\omega_0}{Q} s + \omega_0^2}$$

use v_i = AC source for Spice

In more general case



$v_i = R_i \cdot i_1 + v_1$

$i_1 = G_i(v_i - v_1)$

$v_2 = -R_L i_2 \Rightarrow i_2 = -G_L v_2$

$i_1 = y_{11} v_1 + y_{12} v_2 = G_i(v_i - v_1) \Rightarrow v_1 = f(v_2, v_i)$

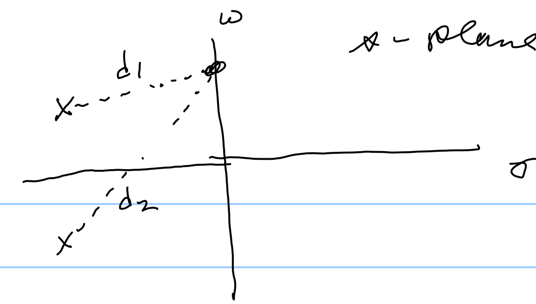
$i_2 = y_{21} v_1 + y_{22} v_2 = -G_L v_2$

$v_2 = v_o$

gives v_2 vs v_i

for degree 2 denominator & degree 0 numerator

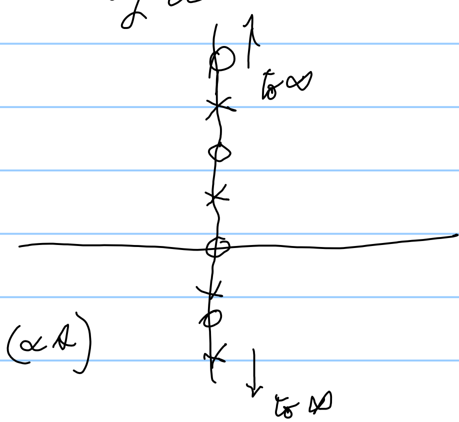
$$A_v(s) = \frac{A}{s^2 + \frac{\omega_0}{Q} s + \omega_0^2}$$



$$|A_v(j\omega)| = \frac{|A|}{d_1(\omega)\, d_2(\omega)}$$

an even function of ω →

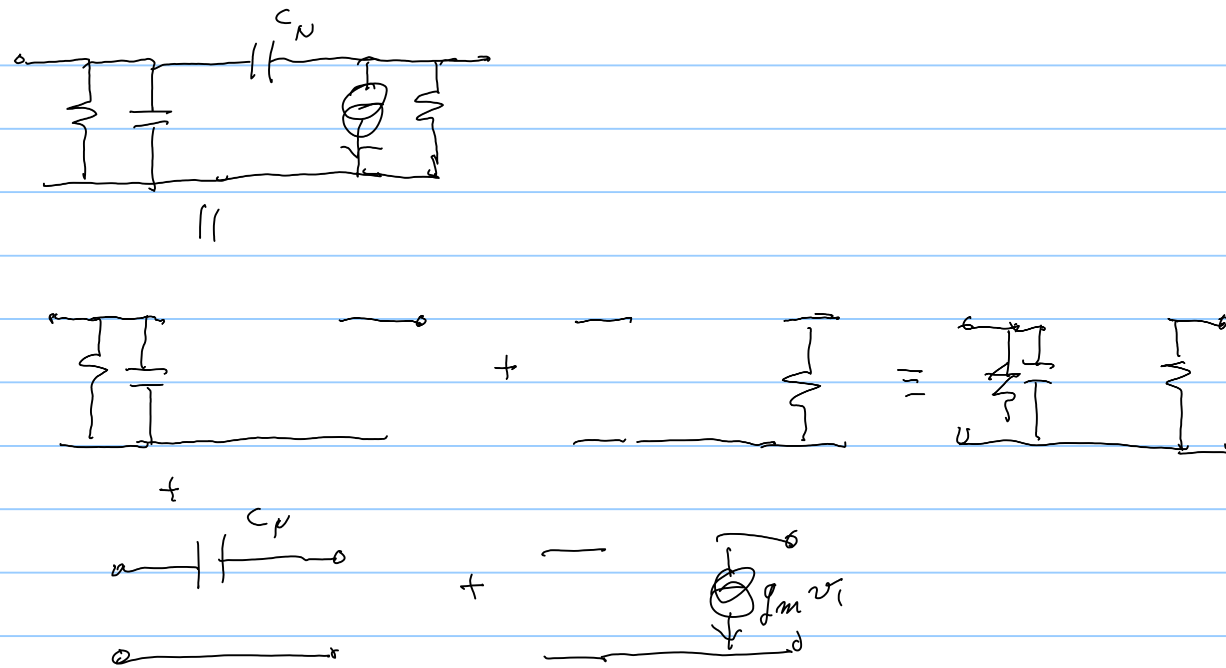
$A_v(s) = A \tanh(s)$



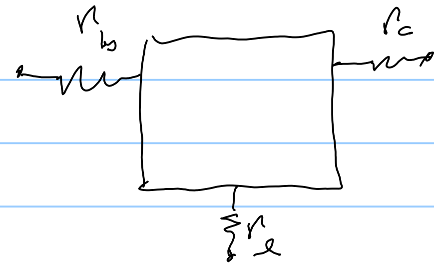
Transmission line $y(s) = g_0 \tanh(\alpha s)$

$y(s) = Cs$

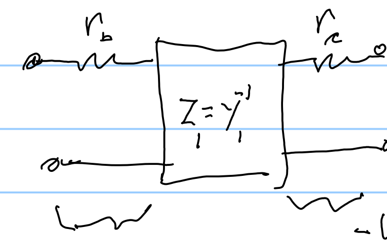
Y(s) for



$$Y(s) \approx \begin{bmatrix} g_{\pi} + sC_{\pi} & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & g_o \end{bmatrix} + \begin{bmatrix} sC_{\mu} & -sC_{\mu} \\ -sC_{\mu} & sC_{\mu} \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ g_m & 0 \end{bmatrix}$$



if $r_e = 0$



$$\left(Z_1 + \begin{bmatrix} r_b & 0 \\ 0 & r_c \end{bmatrix} \right)^{-1} = Y \text{ for whole circuit}$$