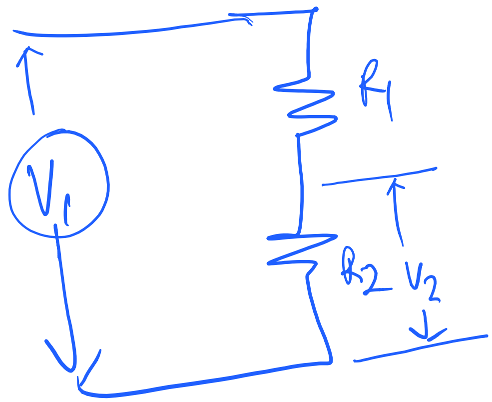
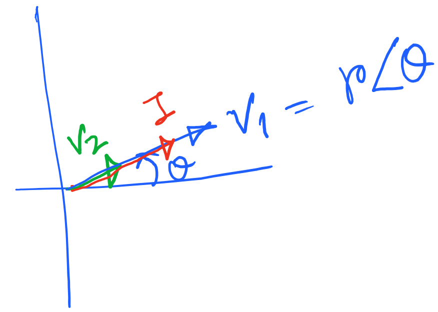
Oscillator-2

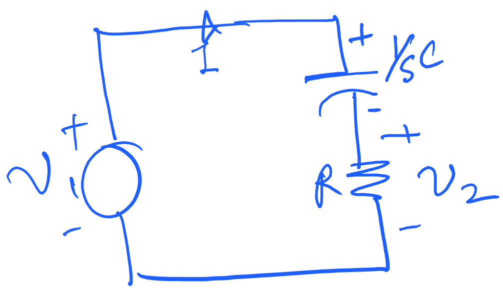
Tuesday, January 31, 2017 1:10 PM





$$I = \frac{V_1}{R_1 + R_2}$$

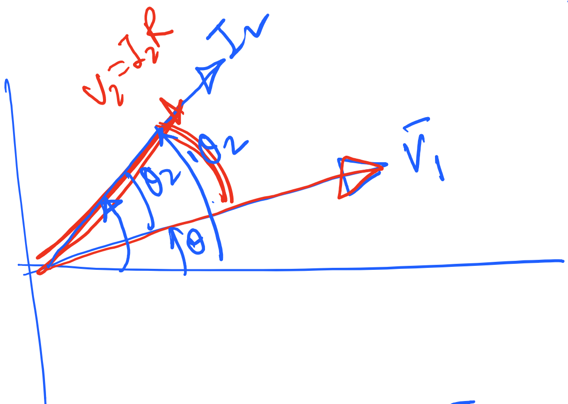
y/x



$$I = \frac{\bar{V}_1}{R + \frac{1}{j\omega C}}$$

$$= \frac{\bar{V}}{R - \frac{j}{\omega C}}$$

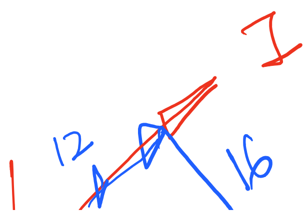
$$\tan\theta = \frac{1}{\omega C R}$$



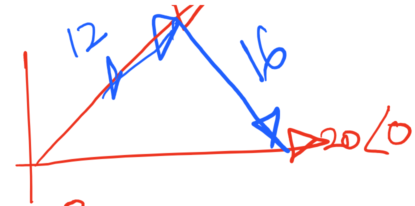
$$I = \frac{\bar{V}}{|Z|\angle{-\theta_1}} = \frac{|\bar{V}|\angle\theta}{|Z|\angle{-\theta_1}}$$

$$I = \frac{|\bar{V}_1|}{|Z|}\angle\theta + \theta_1$$

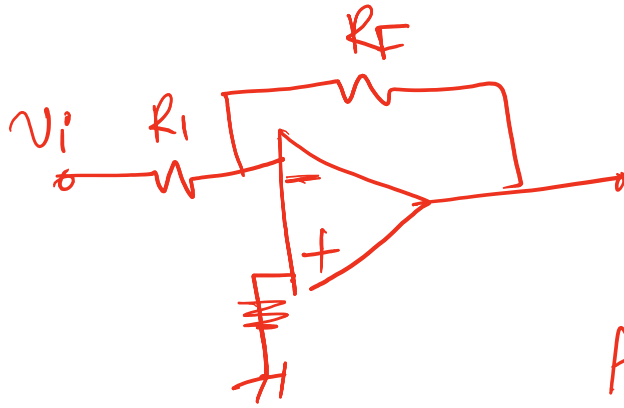
$$V_1 = 20\angle 0$$



$$Z = 3 - j4 = 5\angle -53.13^\circ$$

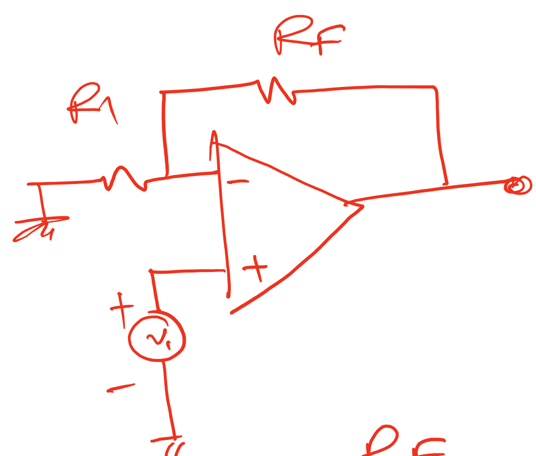


$$I = \frac{V}{Z} = 4\angle 53.13^\circ$$



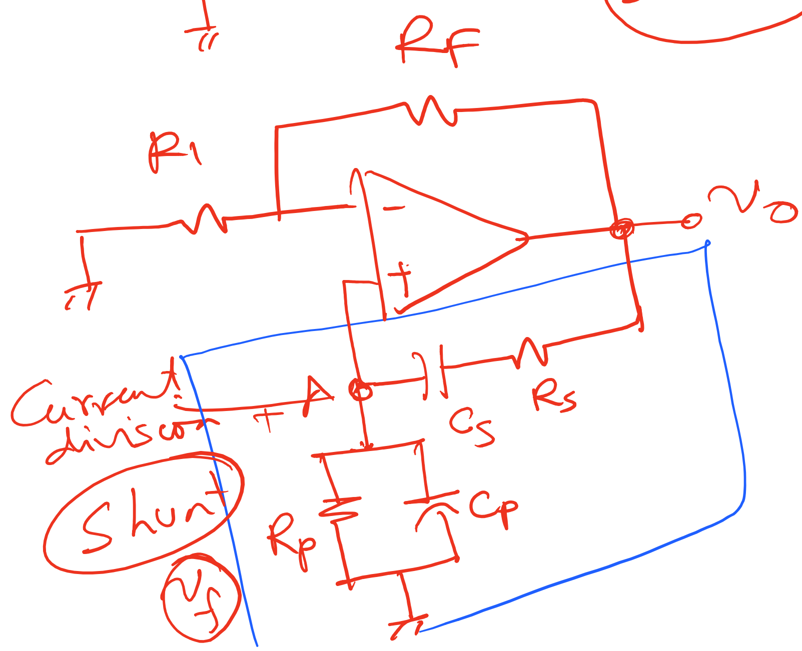
$$v_o = -\frac{R_F}{R_1} v_i$$

$$A = -\frac{R_F}{R_1}$$



$$A = \left(1 + \frac{R_F}{R_1}\right)$$

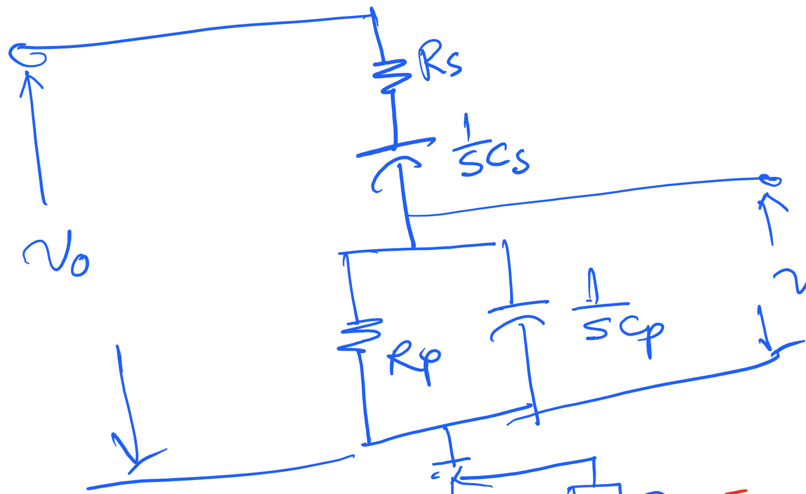
SHUNT



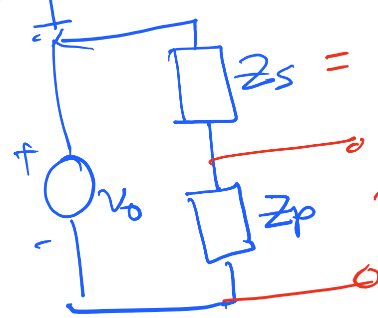
$$A\beta = 1 + j\underline{\underline{0}}$$

$$A = \left(1 + \frac{R_F}{R_1}\right)$$

$$\beta = \frac{v_f}{v_o}$$



$$Z_s = R_s + \frac{1}{sC_s} = \frac{1 + R_s C_s s}{sC_s}$$



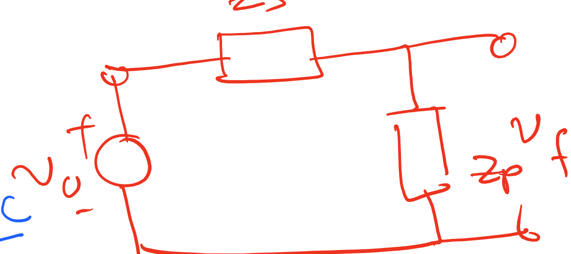
$$v_f = R_p \parallel \frac{1}{sC_p}$$

$$= \frac{R_p \frac{1}{sC_p}}{R_p + \frac{1}{sC_p}}$$

$$= \frac{R_p}{1 + sC_pR_p}$$

$$\cancel{Z_p} + Z_s$$

$$= \frac{1 + R_s C_s S}{sC_s} + \frac{R_p}{1 + sC_pR_p}$$



Let $R_s = R_p = R$

$C_s = C_p = C$

$$Z_p + Z_s = \frac{(1 + RCs)^2 + sRC}{sC\,(1 + sCR)}$$

R

$$Z_p + Z_s = \frac{(1+\ldots}{sC(1+sCR)}$$

$$\beta = \frac{Z_p}{Z_p + Z_s} = \frac{\frac{R}{\cancel{1+sCR}}}{\frac{(1+RCs)^2 + sRC}{sC\cancel{(1+sCR)}}}$$

$$= \frac{RsC}{(1+RCs)^2 + sRC}$$

$$= \frac{RsC}{1 + R^2C^2s^2 + 2RCs + sRC}$$

$$= \frac{RsC}{1 + 3RCs + R^2C^2s^2}$$

Loop gain

$$A\beta = \left(1 + \frac{R_F}{R_1}\right)\left(\frac{RsC}{1 + 3RCs + R^2C^2s^2}\right)$$

$s = j\omega$

$$A\beta = \left(1 + \frac{R_F}{R_1}\right)\left[\frac{j\omega RC}{1 + 3j\omega RC - \omega^2C^2R^2}\right]$$

$$= \left(1 + \frac{R_F}{R_1}\right)\left[\frac{j\omega RC}{(1-\omega^2C^2R^2) + j3\omega RC}\right] = 1 + j0$$

$$1 - \omega_0^2C^2R^2 = 0$$

$$\underline{\omega_0 = \frac{1}{RC}}$$

$$\omega_0 = \frac{1}{RC}$$

$$\boxed{f_0 = \frac{1}{2\pi RC}}$$

$$a + j(c+d) = 1 + j0$$

$$\frac{+j(C+D)}{B+jE} = 1 + j0$$

$$\left(1+\frac{R_F}{R_1}\right)\left[\frac{\cancel{j\omega_0 RC}}{\underbrace{(1-\omega_0^2R^2C^2)}_{0} + \cancel{j3\omega_0 RC}}\right] = 1$$

$$\left(1+\frac{R_F}{R_1}\right)\cdot\frac{1}{3} = 1$$

$$\therefore \underline{\underline{\left(1+\frac{R_F}{R_1}\right) = 3}}$$

<u>Min</u> Amplifier gain is 3

Let $C = 0.1\mu F$

1KHz ,

$$f_0 = \frac{1}{2\pi RC}$$

$$R = \frac{1}{2\pi f_0 C} = \frac{1}{2\pi \times 1K \times 0.1\mu}$$

R_1 , R_F

$$\frac{R_F}{R_1} = 3-1 = 2$$

$R_1 = 10K \quad , \quad R_F = 20K$

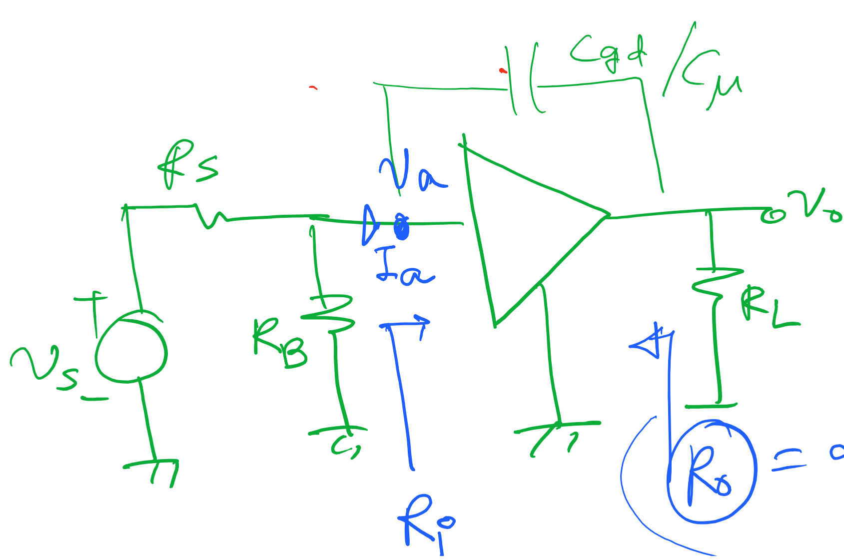
$$T(s) = \frac{10^3 \, s \left(1 + \frac{s}{100}\right)}{\left(1 + \frac{s}{10}\right)\left(1 + \frac{s}{50}\right)}$$

$\omega = 70$ rad/sec

$$\theta = \boxed{90^\circ + \tan^{-1}\frac{\omega}{100} - \tan^{-1}\frac{\omega}{10} - \tan^{-1}\frac{\omega}{50}}$$

$$T(\omega = 70) = \frac{10^3 \times 70}{\left(\cancel{1+}\frac{70}{10}\right)\left(\cancel{1+}\frac{70}{50}\right)}$$

$$T(\omega = 50) = \frac{10^3 \times 50}{\left(\frac{50}{10}\right)}$$



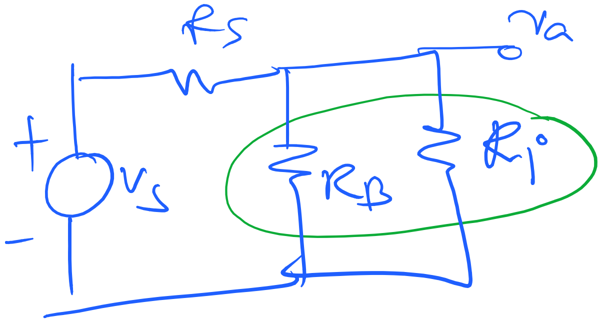
$$A_{v_A} = \frac{v_o}{v_a}$$

$$R_o = \frac{v_a}{I_a}$$

$R_o = \infty$ for $\boxed{CE, CS}$

$R_S \| R_B + r_\pi \quad C_\pi C$

R_i



$R_i' = R_B \| R_i$

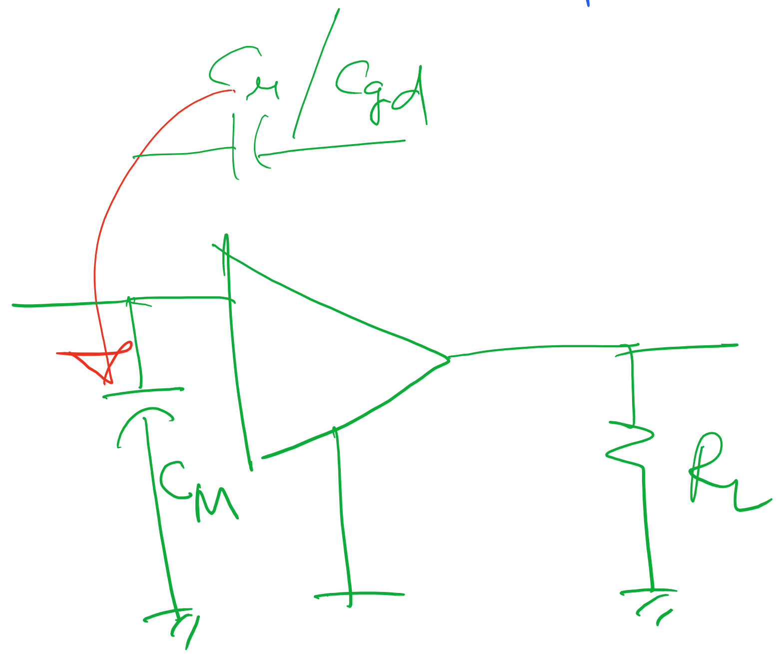
$$\frac{R_S \| R_B + r_\pi}{(1+\beta)} \quad \text{CC}$$

$1/g_m$

CD

$$A_v = A_{vA} \times \frac{v_a}{v_s}$$

$$= A_{vA} \times \frac{R_i'}{R_i' + R_S}$$



$$C_M = C_\mu \left[1 + |A_{vA}|\right]$$

$$C_{gd} \left[1 + |A_{vA}|\right]$$

$$f_L = \frac{1}{2\pi (R_S + R_i) C_{C1}}$$

$$f_L = \frac{1}{2\pi (R_L + R_o) C_{C2}}$$

$$f_H = \frac{1}{2\pi R_L' C_L}$$

$R_L' = R_o \| R_L$

$$f_{HM} = \frac{1}{2\pi R_S \| R_i \times C_T} \rightarrow C_T = C_M + C_\pi$$

$$= C_M + C_{gs}$$