Transistor Amplifier

Monday, September 25, 2017 8:35 AM

phase vs freq

$$T(s) = \frac{(s+50)}{s} \cdot \frac{50\left(1+\frac{s}{50}\right)}{j\omega} \cdots \frac{}{\omega \angle 90^\circ}$$

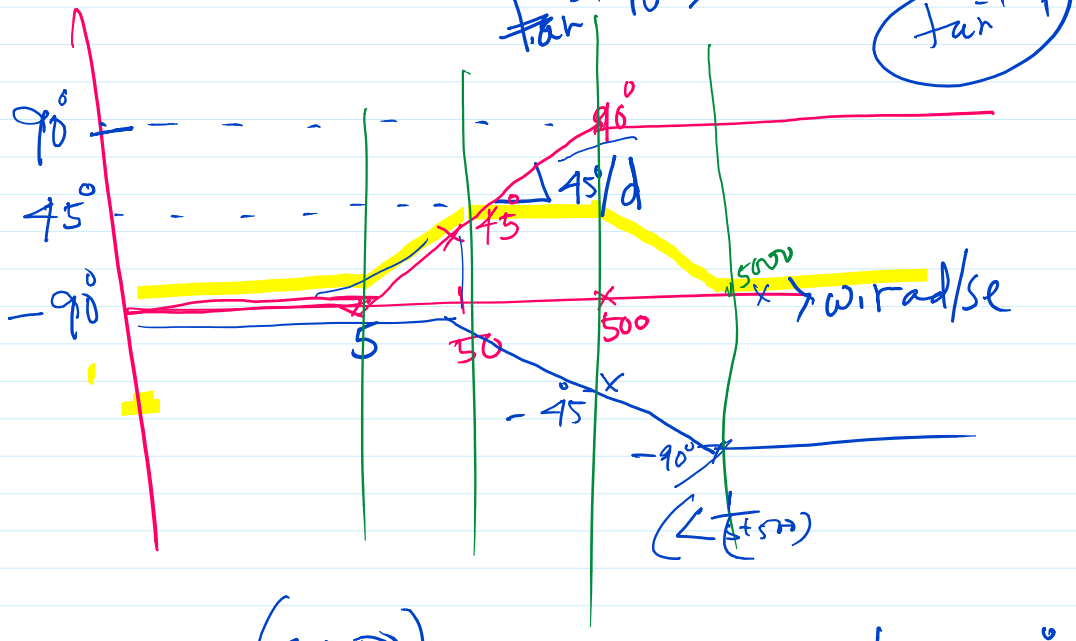
-90

$$= \frac{50\left(1+\frac{j\omega}{50}\right)}{j\omega} = \frac{\tan^{-1}\frac{\omega}{50}}{j\omega}$$

$\omega_c = 50$

$\tan^{-1} 0.1 \simeq 0$

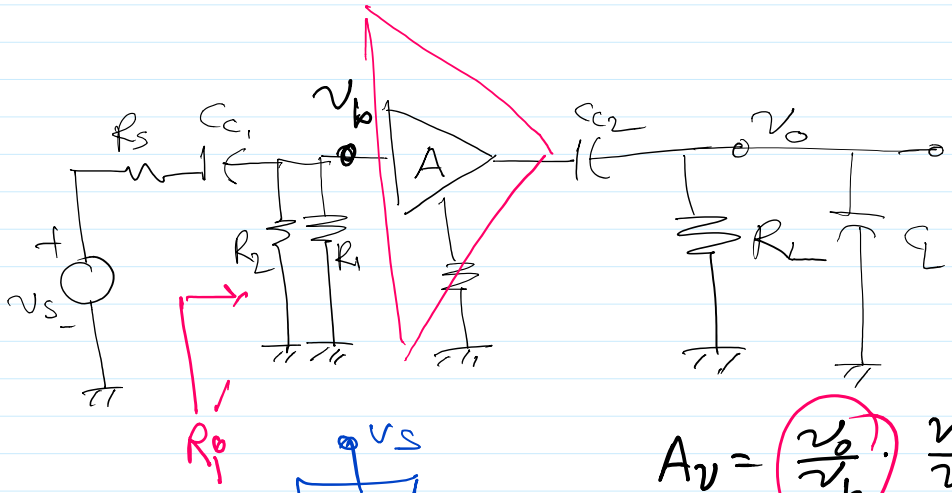
$\tan^{-1} 10 \simeq 90^\circ$ $\tan^{-1}\frac{\omega}{50}$ $\tan^{-1} 1$



$$T(s) = \frac{(s+50)}{s(s+500)}$$

$$\theta = \tan^{-1}\frac{\omega}{50} - 90^\circ - \tan^{-1}\frac{\omega}{500}$$

$$T(s) = \frac{v_o}{v_i}$$

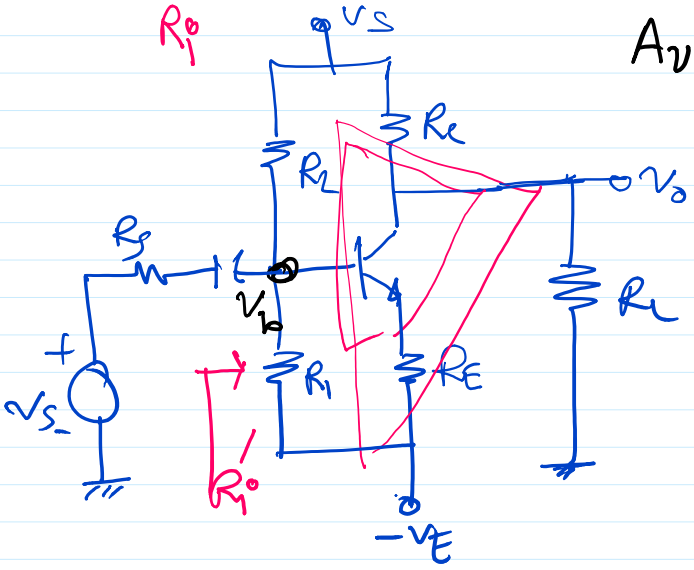


$$A_{v_A} = \frac{v_o}{v_b}$$

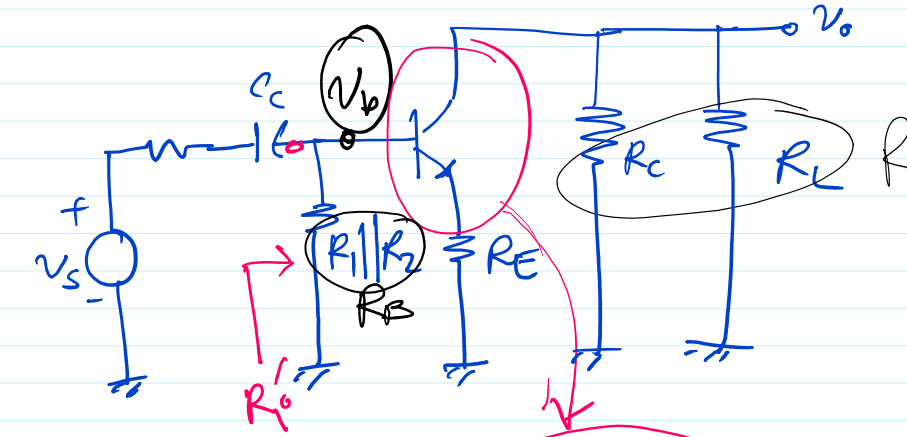
$$A_v = \frac{v_o}{v_s}$$

$$A_v = \frac{v_o}{v_b} \cdot \frac{v_b}{v_s}$$

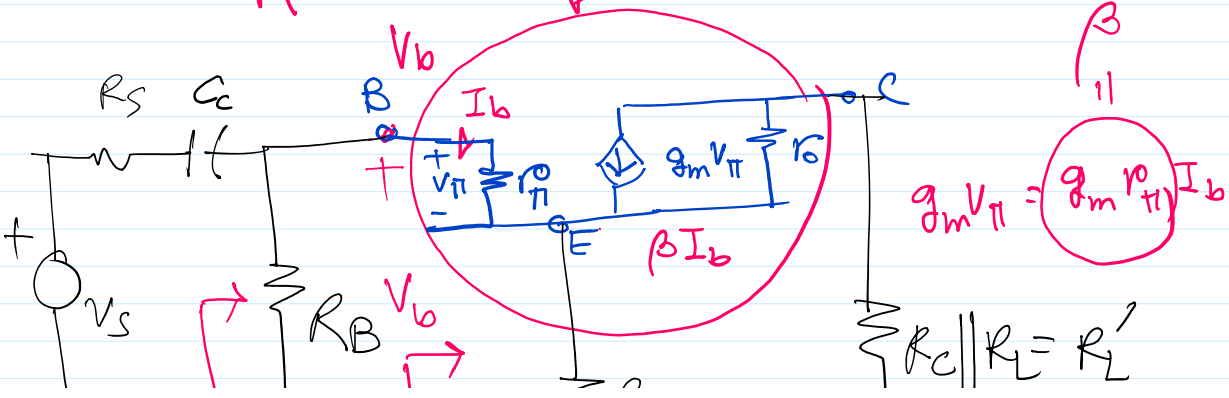
$$= A_{v_A} \times \frac{v_b}{v_s}$$



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

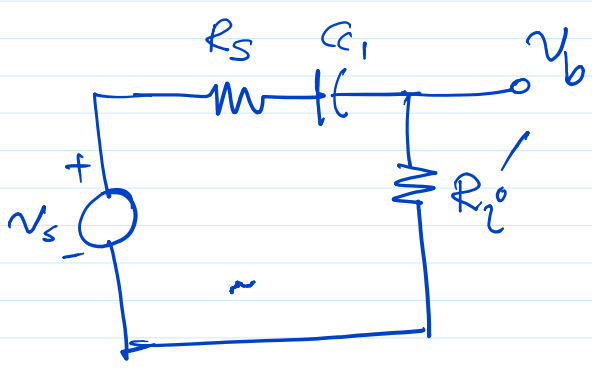


$$R_L' = R_C \| R_L$$



$$g_m v_\pi = (g_m r_\pi) I_b$$

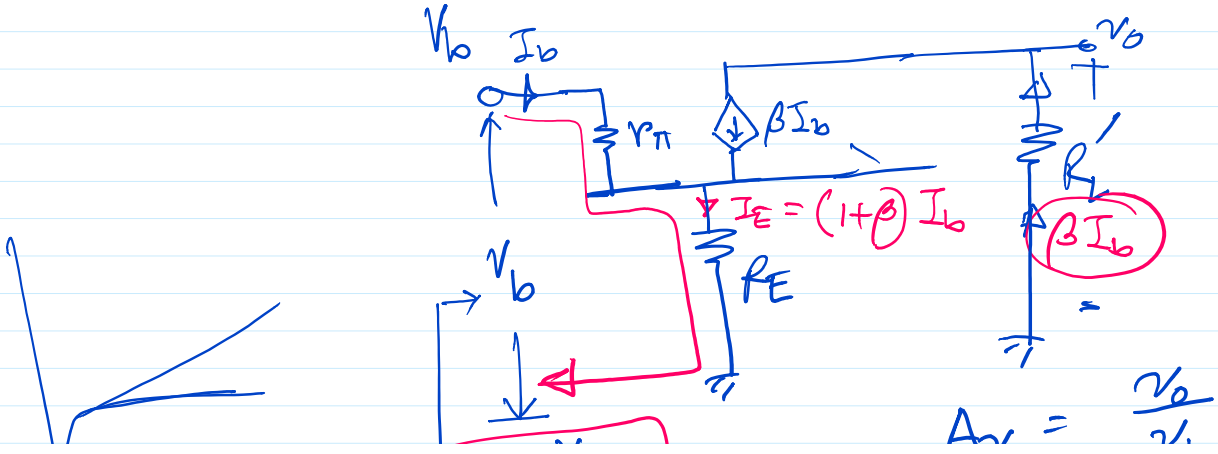
$$A_v = \frac{v_o}{v_s}\Big|_{\text{Low freq}} \qquad A_v = \frac{v_o}{v_s}\Big|_{\text{Mid freq}}$$



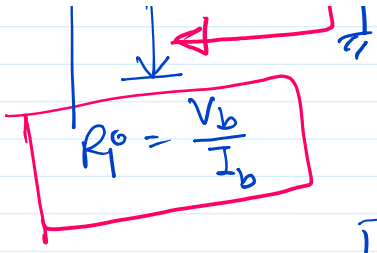
$$\frac{v_b}{v_s}\Big|_{\text{Low freq}} = \frac{R_i^o}{(R_i^o + R_s) + \frac{1}{sC_{c_1}}}$$

$$\frac{v_b}{v_s}\Big|_{\text{mid}} = \frac{R_i^o}{R_s + R_i^o}$$

$$f_L = \frac{1}{2\pi\tau} \qquad \tau = C_{c_1}\left[R_s + R_i^o\right]$$



$$A_v = \frac{v_o}{v_i}$$



$$A_{V_A} = \frac{V_o}{V_b}$$

$$r_o = \infty$$

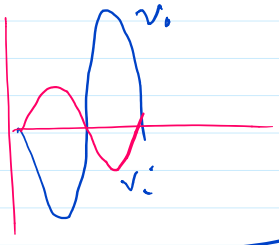
$$V_o = -\beta I_b R_L'$$

$$V_b = r_\pi I_b + R_E(1+\beta) I_b$$

$$= [r_\pi + R_E(1+\beta)] I_b$$

$$R_i = \frac{V_b}{I_b} = r_\pi + R_E(1+\beta)$$

$$A_{V_A} = \frac{V_o}{V_b} = \frac{-\beta I_b R_L'}{[r_\pi + R_E(1+\beta)] I_b}$$



$$= -\frac{\beta R_L'}{r_\pi + R_E(1+\beta)}$$

$R_E = 0$ $\quad A_{V_A} = -\frac{\beta R_L'}{r_\pi}$

$$A_{V_A} \simeq \frac{-\beta R_L'}{r_\pi + \beta R_E}$$

$$\simeq -\frac{\beta R_L'}{\beta R_E} = -\frac{R_L'}{R_E}$$

$$A_{VA}' = \frac{\beta R_E'}{r_\pi + \beta R_E'} \simeq -\frac{\beta R_L'}{\beta R_E} = -\frac{R_L'}{R_E}$$

$$R_i' = R_i \| R_1 \| R_2$$

$$A_v = \frac{v_2}{v_s} = A_{VA} \times \frac{v_b}{v_s}$$

$$A_v|_{low} = \frac{-\beta R_L'}{r_\pi + (1+\beta) R_E} \times \frac{R_i'}{R_i' + R_s + \frac{1}{sC_c}}$$

$$A_v|_{mid} = \frac{-\beta R_L'}{r_\pi + (1+\beta) R_E} \times \frac{R_i'}{R_i' + R_s}$$