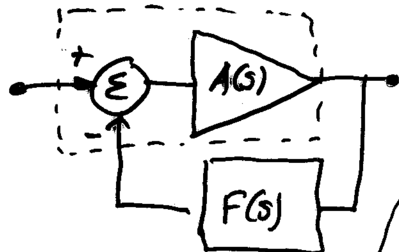
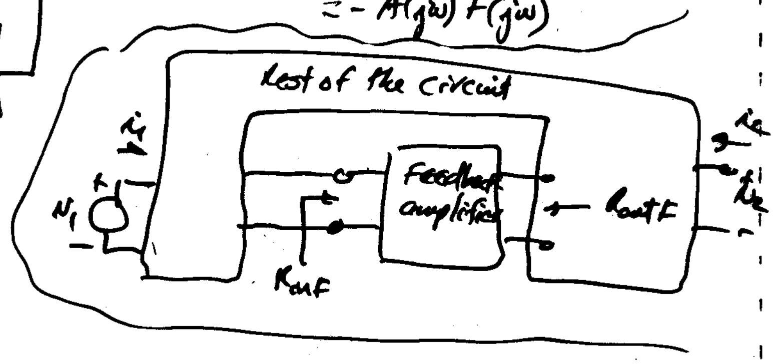
Stability of a feedback network -

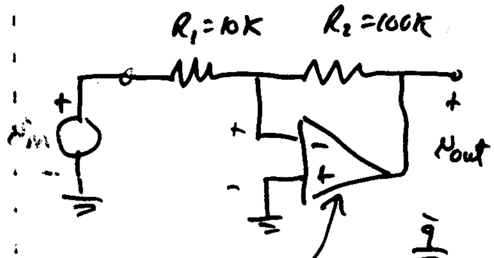


Loop gain = $-A(s)F(s)$

$= -A(j\omega)F(j\omega)$



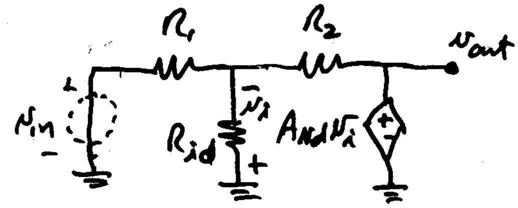
Find the loop gain -



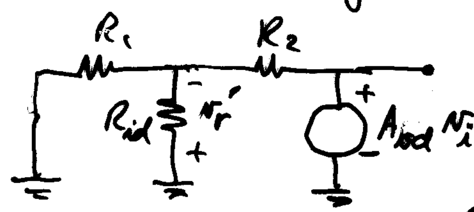
$R_o = 0$

$R_{id} = 100K$

$A_{vd} = 10^4$



↓ Finding the loop



Loop gain $= T = -\dfrac{v_r}{v_i} = -\dfrac{v_r'}{v_i'}$

$$v_r = -A_{vd}v_i\left(\frac{R_{id}\|R_1}{R_2 + R_{id}\|R_1}\right) \rightarrow T = -\frac{v_r}{v_i} = \frac{10^4(100K\|10K)}{100K + (100K\|10K)}$$

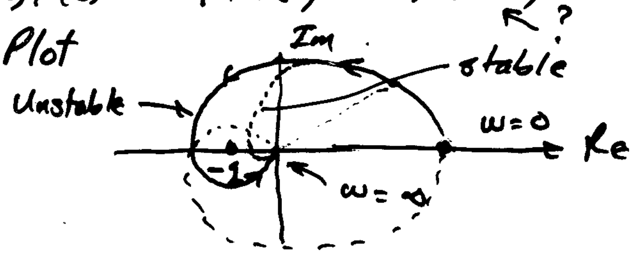
$\underline{\underline{T = 83.33}}$

Stability of Feedback Amplifiers

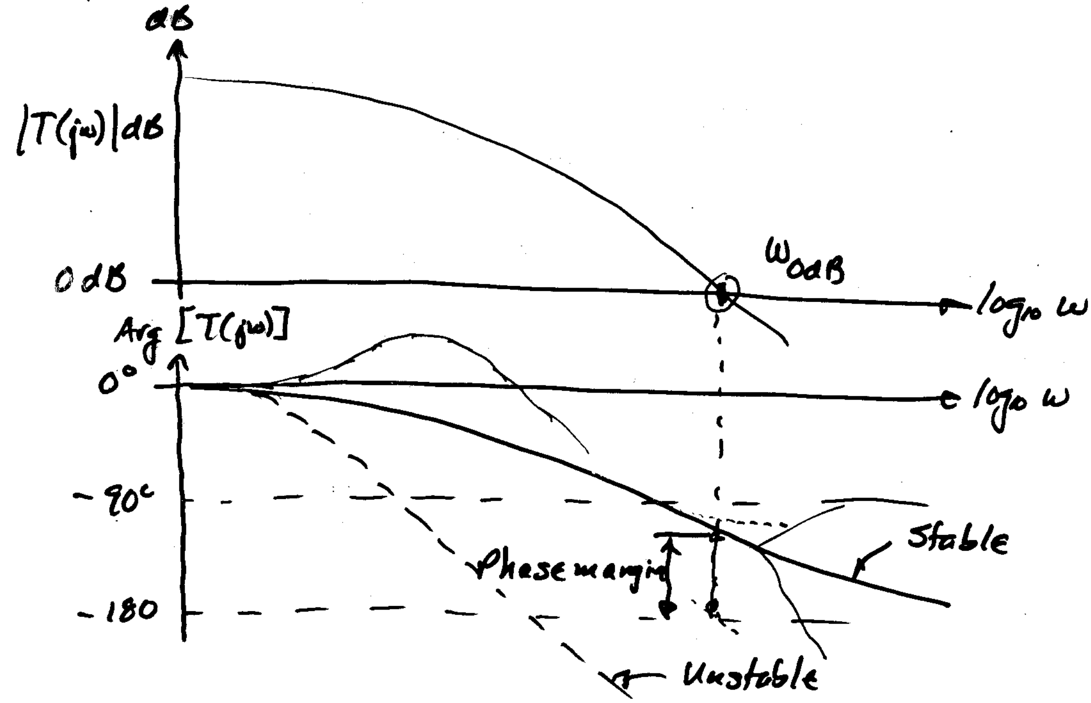
$$A_F(s) = \frac{A(s)}{1 + A(s)F(s)} = \frac{A(s)}{1 + T(s)} = \frac{A(s)}{1 + LG(s)}$$

?

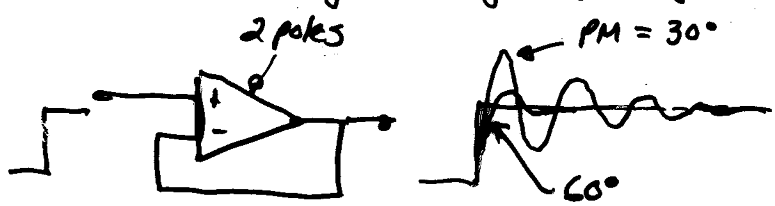
1.) Nyquist Plot



2.) Bode Plot



Phase margin = Arg $[T(j\omega_{0dB})] + 180°$



Example –

Assume $A(s) = \dfrac{1000}{\left(\frac{s}{100}+1\right)\left(\frac{s}{10^5}+1\right)}$ & $B(s) = 1$

Find the phase margin.

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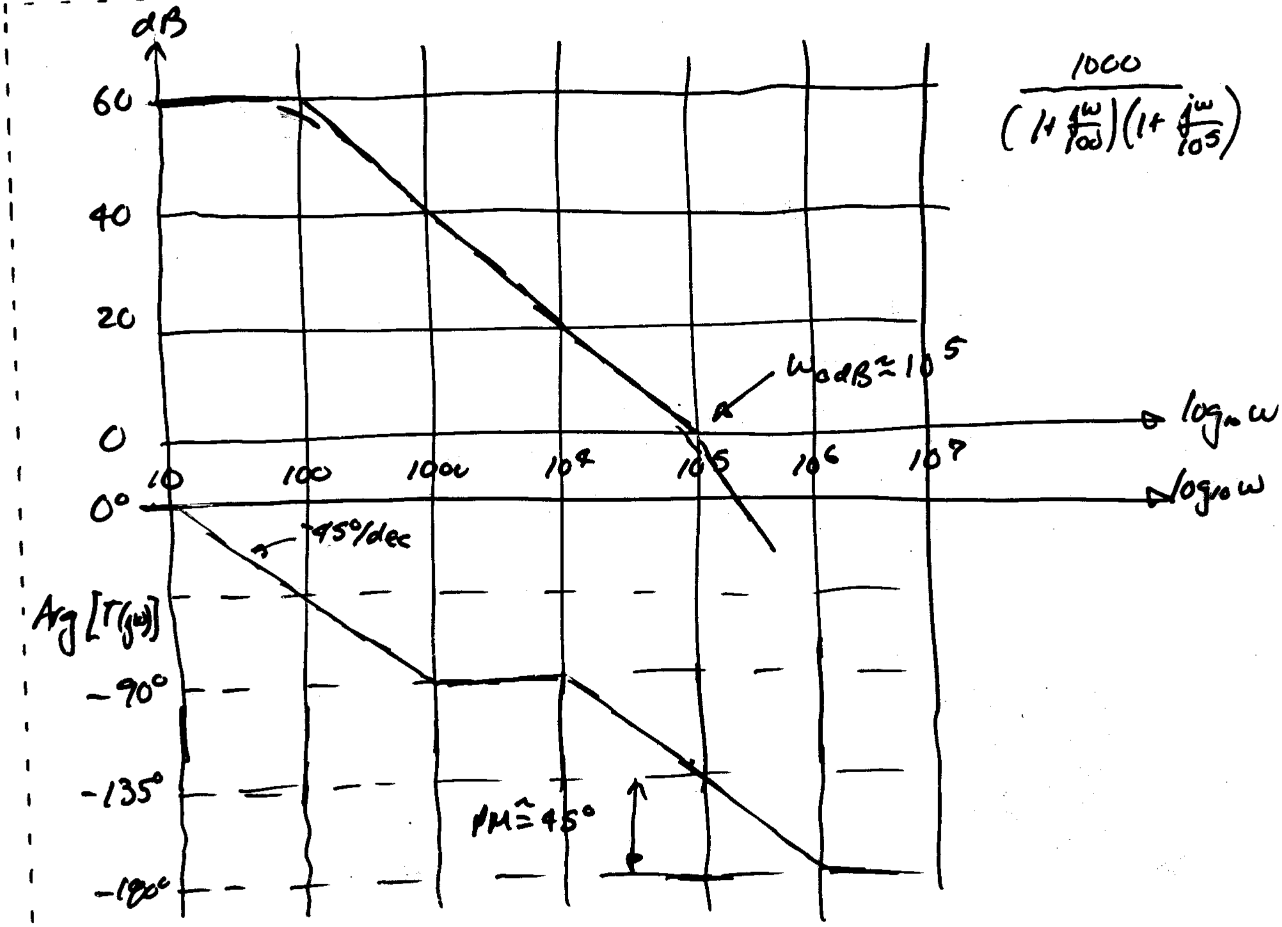

Summary of Feedback Stability (After lecture)

A feedback amplifier is stable if –

a.) $\text{Arg}\left[T(j\omega_{0dB})\right] > -180^\circ$ i.e. the loop phase shift is more positive than -180° when the loop magnitude is unity

b.) $\left|T(j\omega_{-180^\circ})\right| < 1$ i.e. The magnitude of the loop gain is less than unity at the frequency where the loop phase shift is -180°.