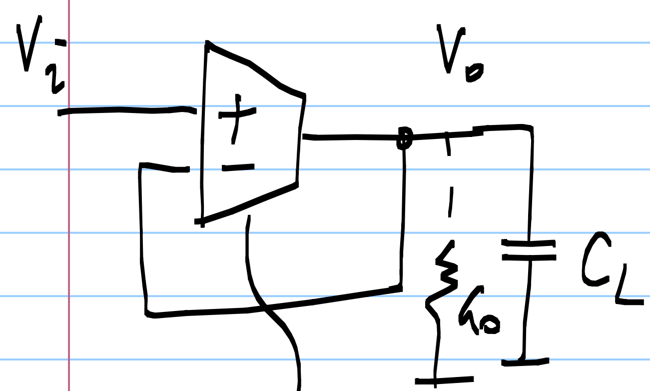
Lecture 20

1/3/2016

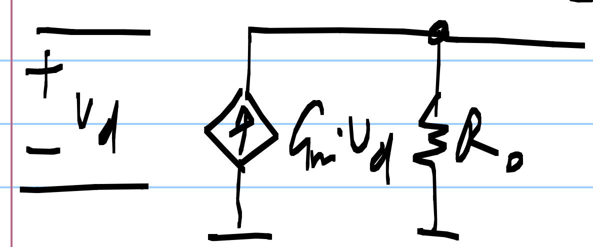
$\tau : \dfrac{C_L}{G_m + G_o}$



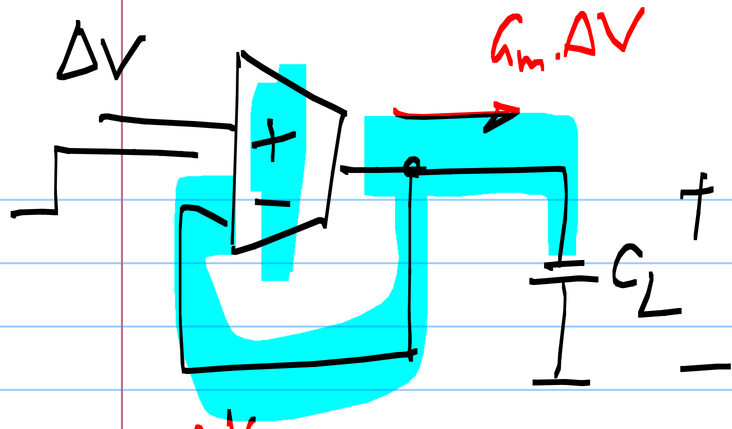
$$\frac{V_o}{V_i} \simeq \frac{1}{1 + sC_L/G_m}$$

$sC_L \rightarrow sC_L + G_o$

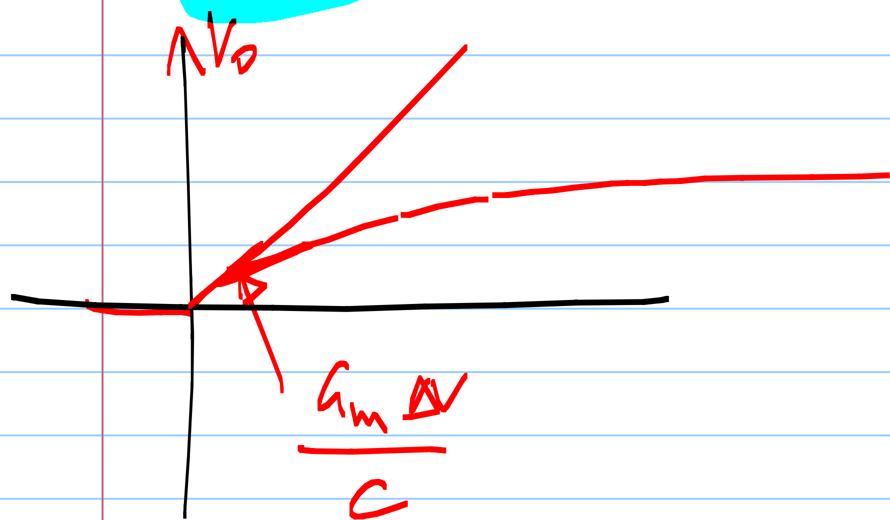
$$= \frac{1}{1 + \frac{G_o}{G_m} + sC_L/G_m}$$



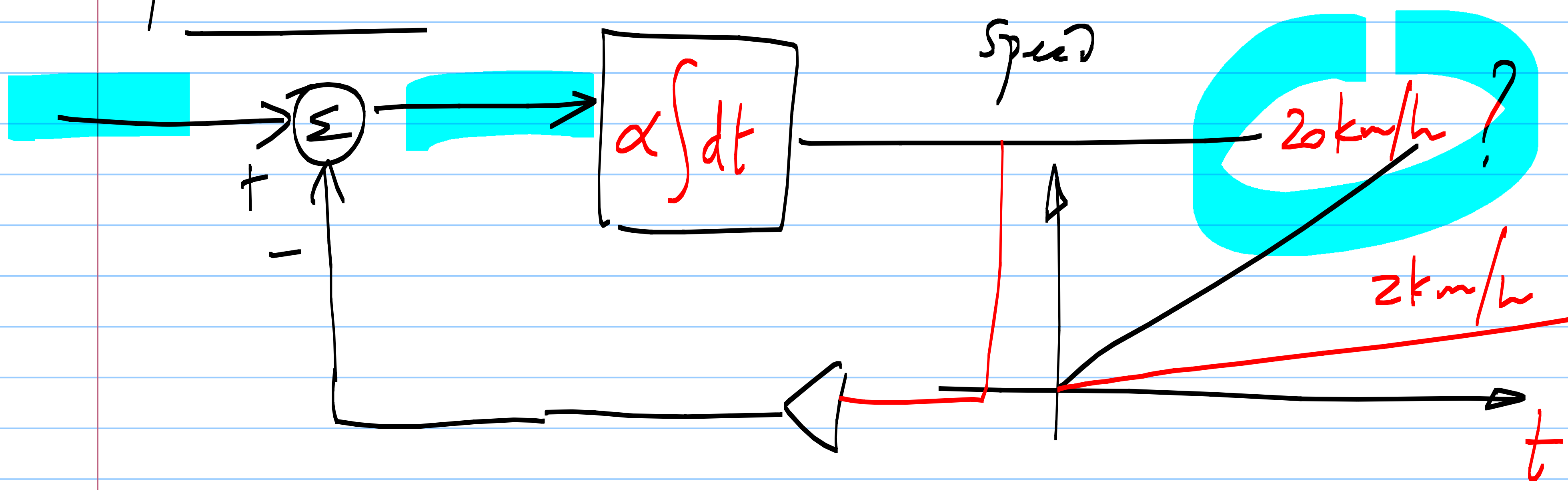
$$v_o(t) = \frac{1}{1 + G_o/G_m}\left(1 - \exp\left(-t/\tau\right)\right)$$



$$i_c = C \cdot \frac{dV}{dt}$$

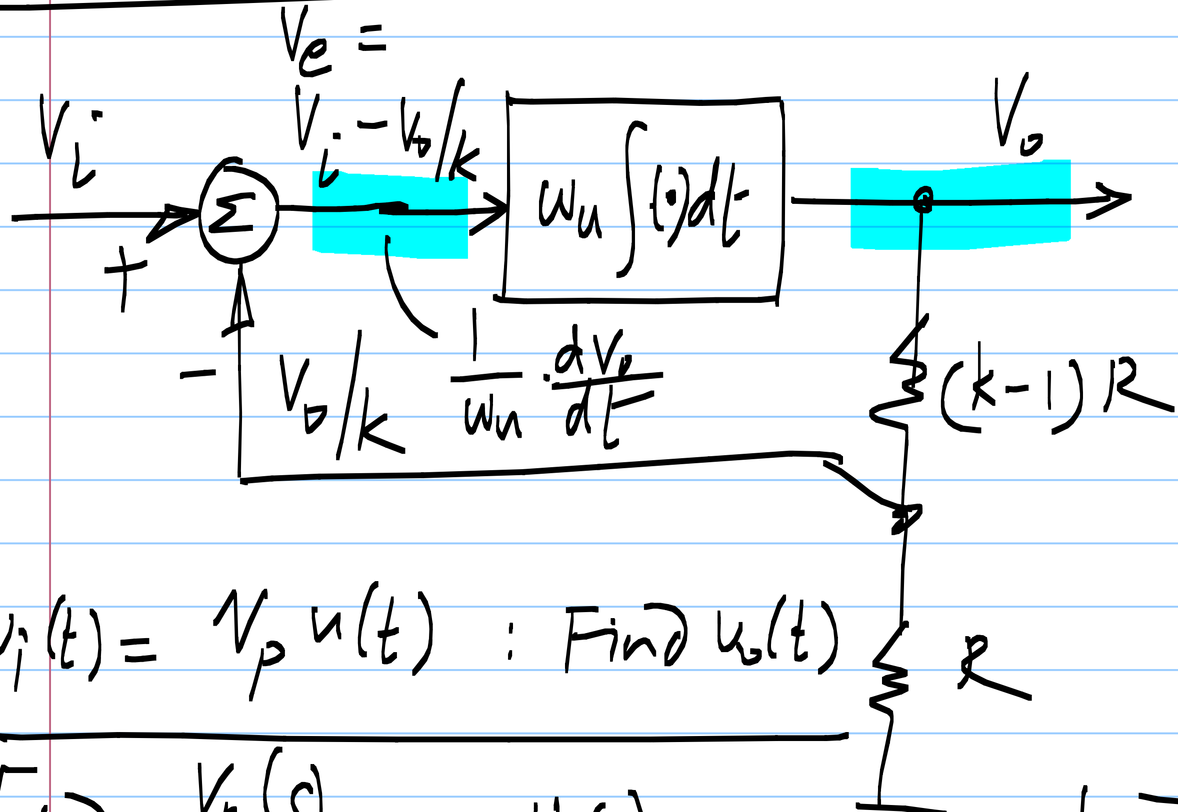


Negative feedback: Continuous adjustment of the o/p to reduce the error between input & feedback



Amplifier; $V_o = k V_i$

Negative feedback



$$k\left(\frac{V_o}{k} - V_i\right)$$

$$\left(V_i - \frac{V_o}{k}\right)$$

$v_i(t) = V_p\, u(t)$: Find $v_o(t)$

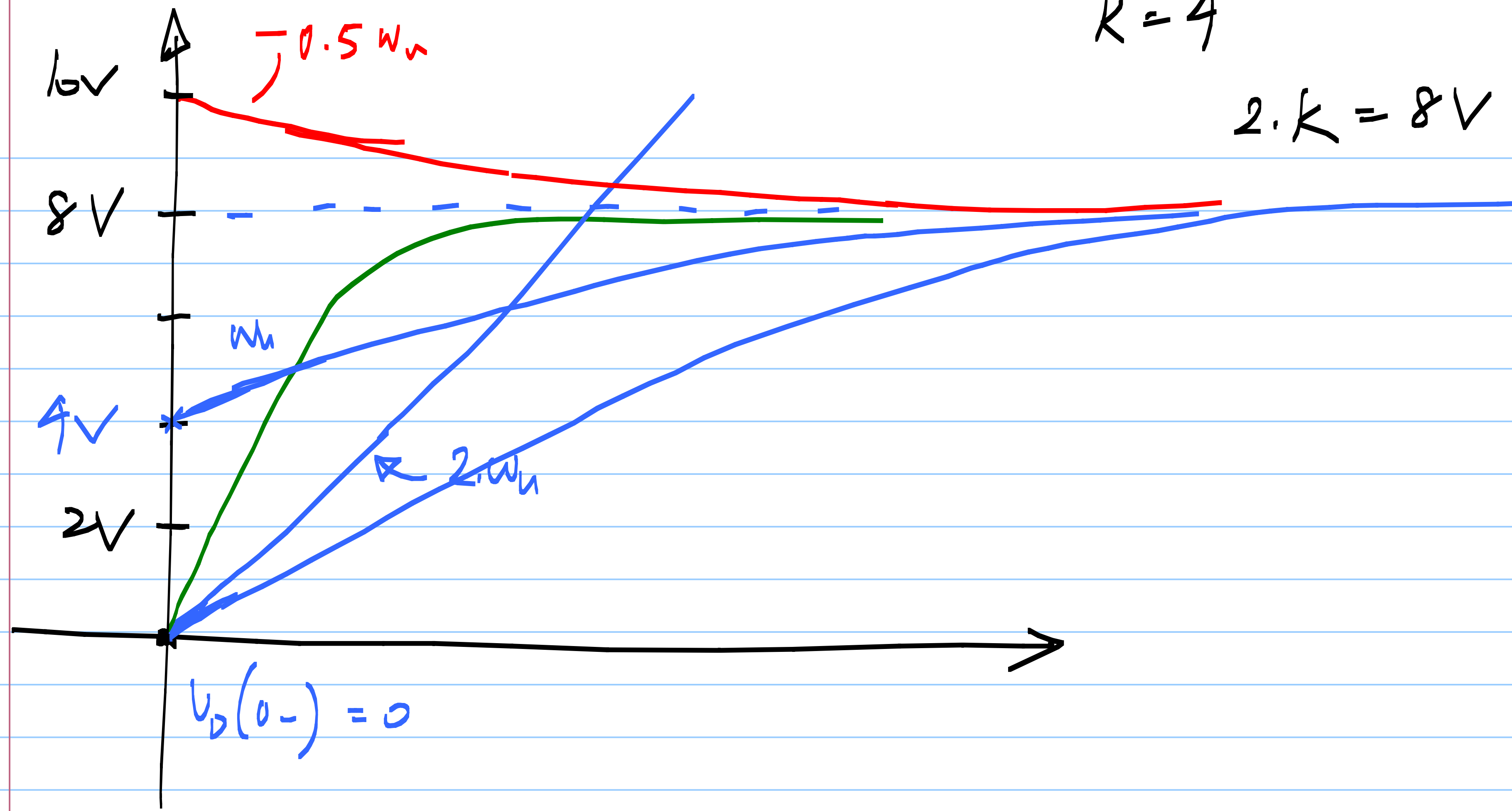
Find $\dfrac{V_o(s)}{V_i(s)} = H(s)$

$$V_p \cos(\omega_i t)$$

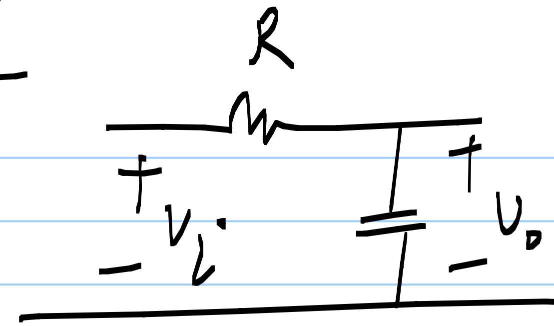
$$|H(j\omega_i)|\, V_p \cdot \cos\left(\omega_i t + \measuredangle H(j\omega_i)\right)$$

$k = 4$

$2 \cdot k = 8V$



Step response: $v_i(t) = V_p\, u(t)$



$$\frac{k}{\omega_n} \cdot \frac{dv_o}{dt} + v_o = k v_i$$

$$RC \frac{dv_o}{dt} + v_o = v_i$$

$$v_o(t) = V(0) \exp(-t/\tau) + k \cdot V_p \left[1 - \exp(-t/\tau)\right]$$

$$\tau = k/\omega_n$$

$$H(s)\ \frac{V_o(s)}{V_i(s)} = \frac{\omega_u}{s + \omega_u/k} = k \cdot \left[\frac{1}{1 + \frac{s}{(\omega_u/k)}} \right]$$

Pole @ $-\frac{\omega_u}{k}$

$$|H(j\omega)| = \frac{k}{\sqrt{1 + \frac{\omega^2}{(\omega_u/k)^2}}} \simeq k$$

$$\omega \ll \frac{\omega_u}{k}$$

$$\angle H(j\omega)$$

$$= \left(\frac{\omega_u}{\omega} \right)$$

$$\omega \gg \frac{\omega_u}{k}$$

$$\angle H(j\omega) = -\tan^{-1}\left(\frac{\omega}{(\omega_n/k)}\right) \qquad -\tan^{-1} x \qquad \underline{x}$$

$$V_p \cos(\omega_i t)$$

$$\frac{k V_p \cdot}{\sqrt{1 + \left(\frac{\omega_i}{\omega_n/k}\right)^2}} \cos\left(\omega_i \cdot t - \tan^{-1}\frac{\omega_i}{(\omega_n/k)}\right)$$