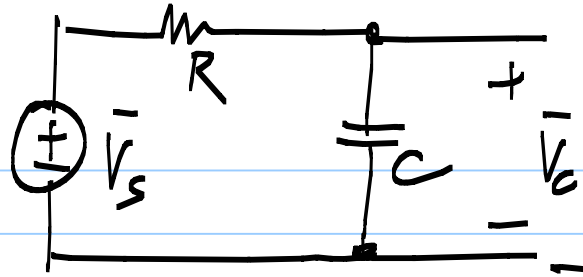
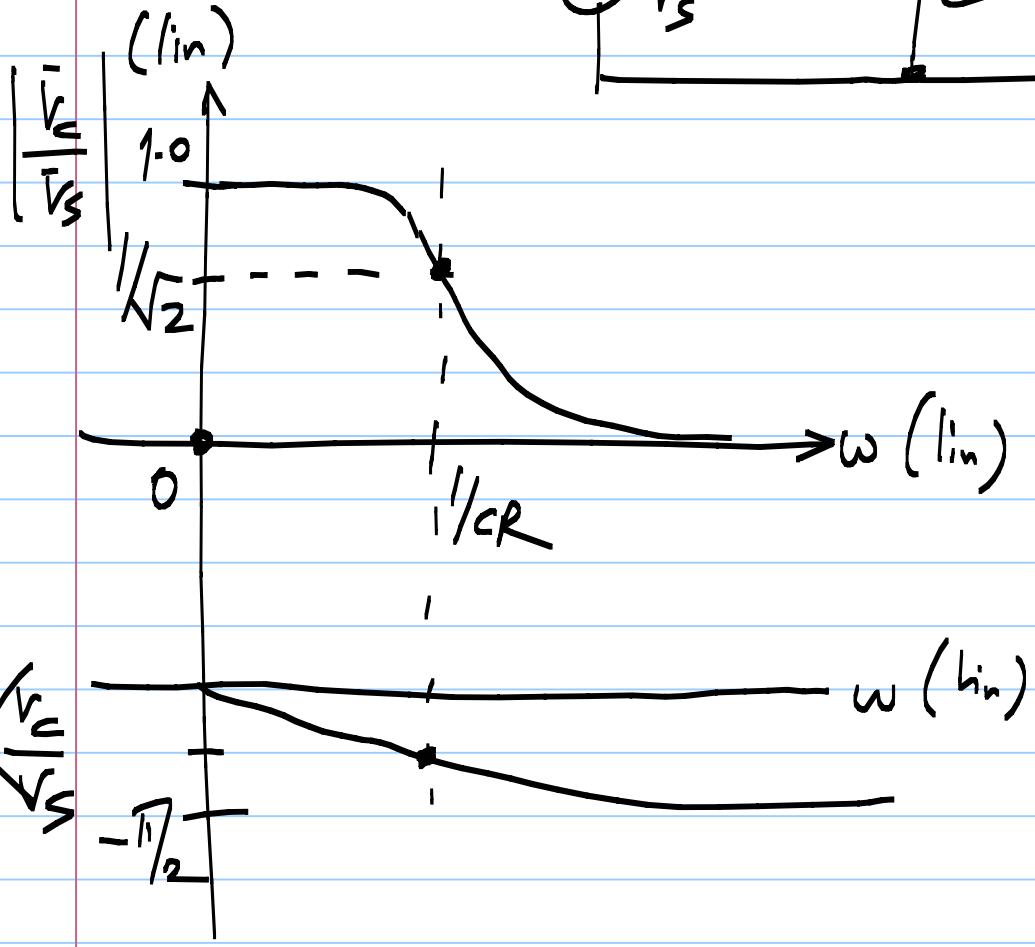
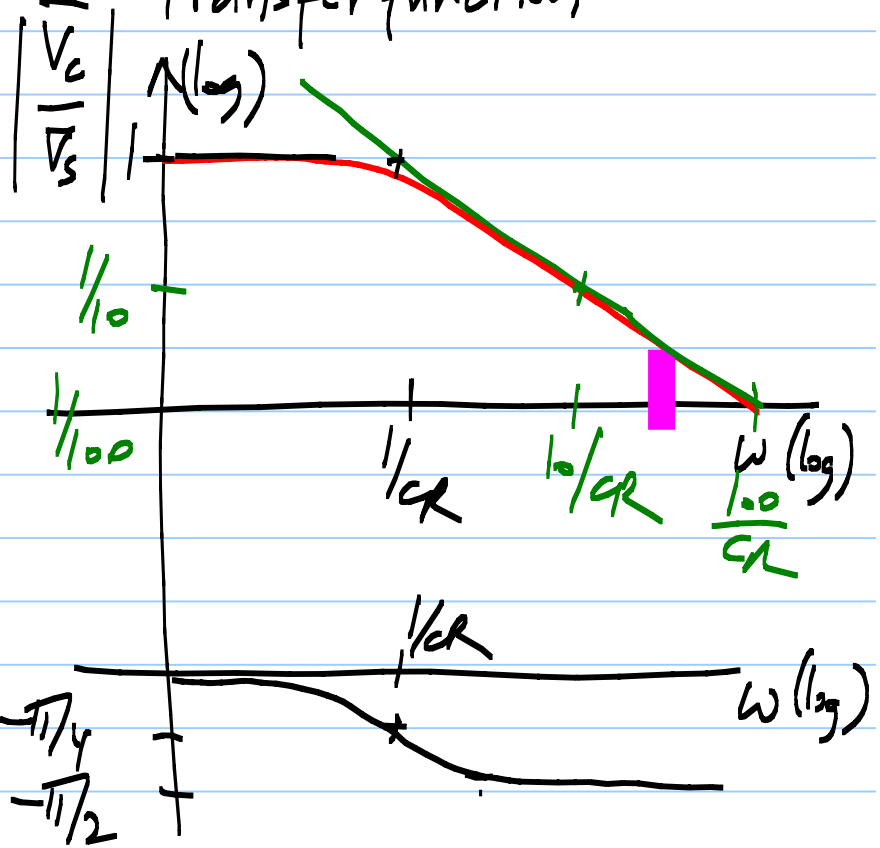
Lecture 29



$$\frac{\bar{V}_c}{\bar{V}_s} = \frac{1}{1 + j\omega CR}$$

Transfer function





$$\left|\frac{\bar{V}_c}{\bar{V}_s}\right| \simeq \frac{1}{\omega CR} \quad \text{if} \quad \omega \gg \frac{1}{CR}$$

$$\log\left|\frac{\bar{V}_c}{\bar{V}_s}\right| = -\log(CR) - \log(\omega)$$

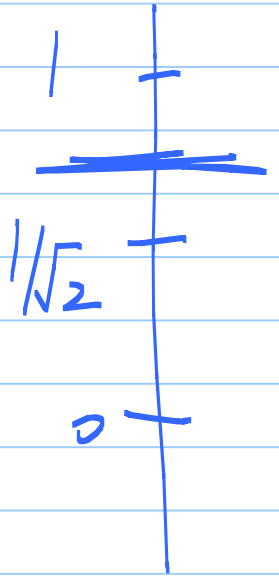
$$\not\angle \frac{\bar{V}_c}{\bar{V}_s} = -\tan^{-1}(\omega CR) = -\tan^{-1}\left(\frac{\omega}{1/CR}\right)$$

$$+\tan^{-1}(\omega_1 CR) = +\pi \qquad \omega_1 CR = \tan(\pi)$$

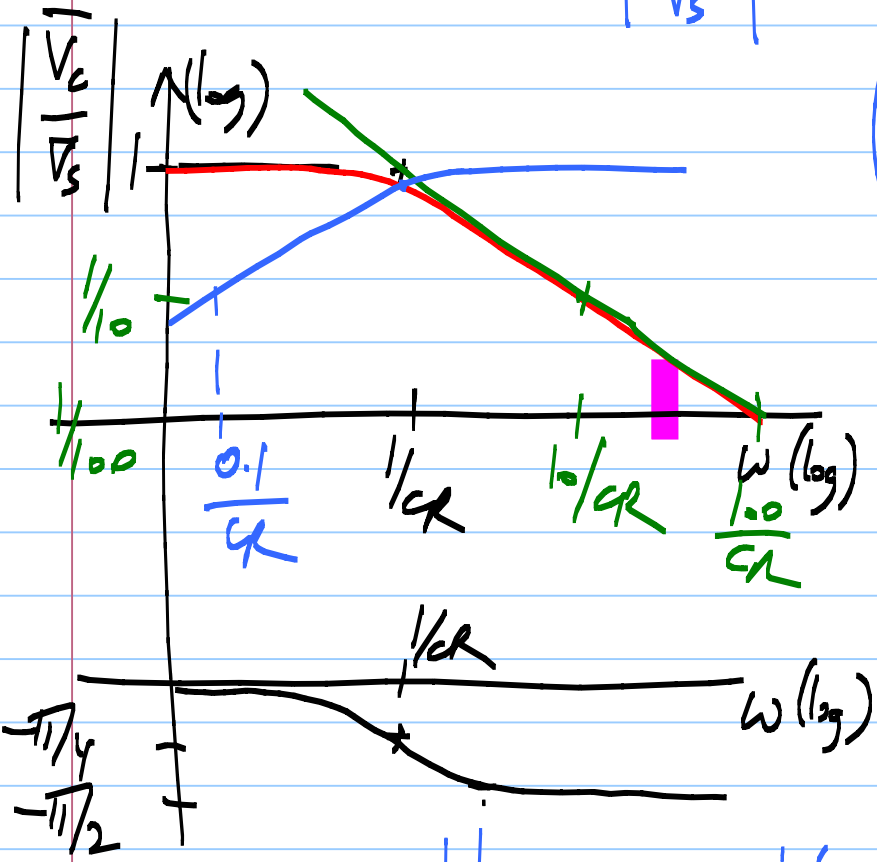
$$+\tan^{-1}(\omega_2 CR) = +\left(\frac{\pi}{2} - \pi\right) \qquad \omega_2 CR = \tan\left(\frac{\pi}{2} - \pi\right) = \frac{1}{\tan\pi}$$

deciBel unit : $20 \log_{10} \left| \frac{\bar{V}_o}{\bar{V}_s} \right|$ dB

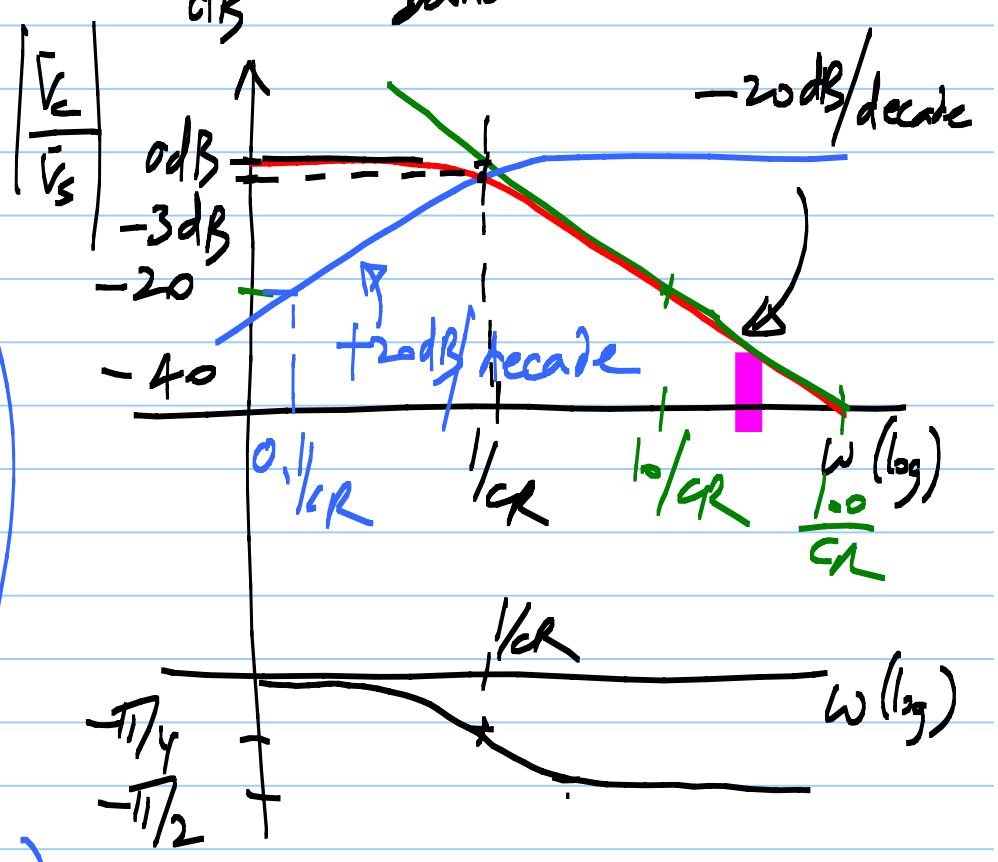
$20 \log_{10}$ (voltage ratio , current ratio)



$\left|\frac{V_R}{V_S}\right|$ Bode Plots



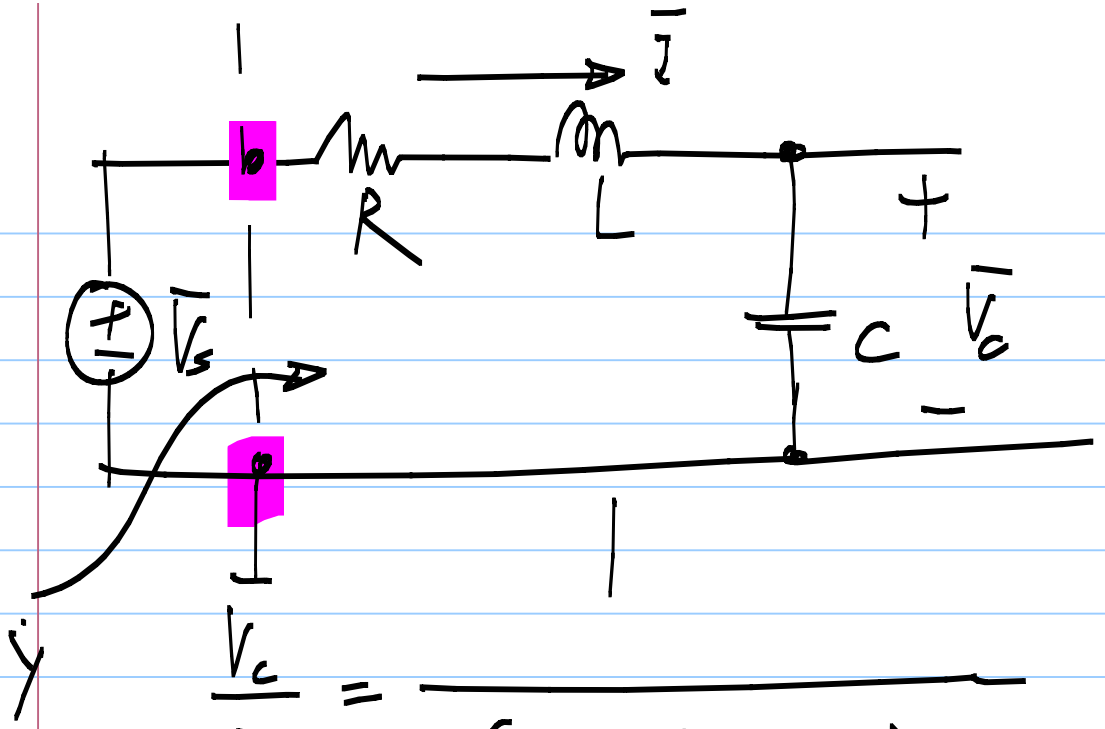
3 dB bandwidth

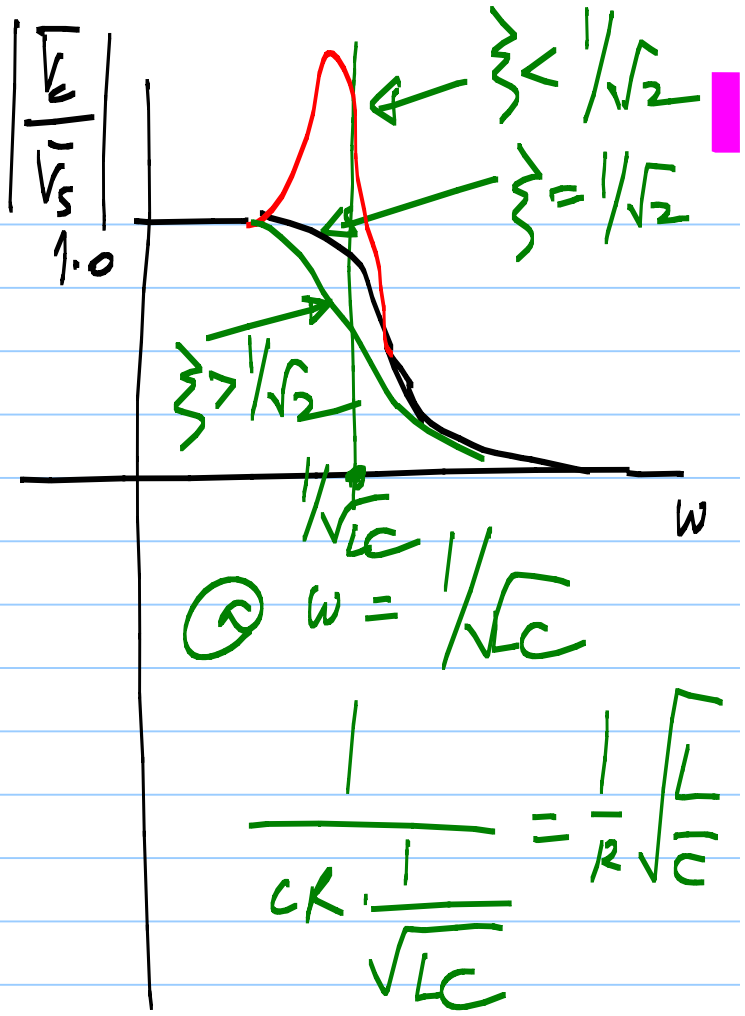


Hendrik W Bode

$$\left|\frac{\bar{V}_R}{\bar{V}_S}\right| = \left|\frac{j\omega CR}{1+j\omega CR}\right| \simeq \begin{cases} \omega CR & \omega \ll 1/CR \\ 1 & \omega \gg 1/CR \end{cases}$$

$$\log\left|\frac{\bar{V}_R}{\bar{V}_S}\right| = +\log(CR) + \log(\omega)$$





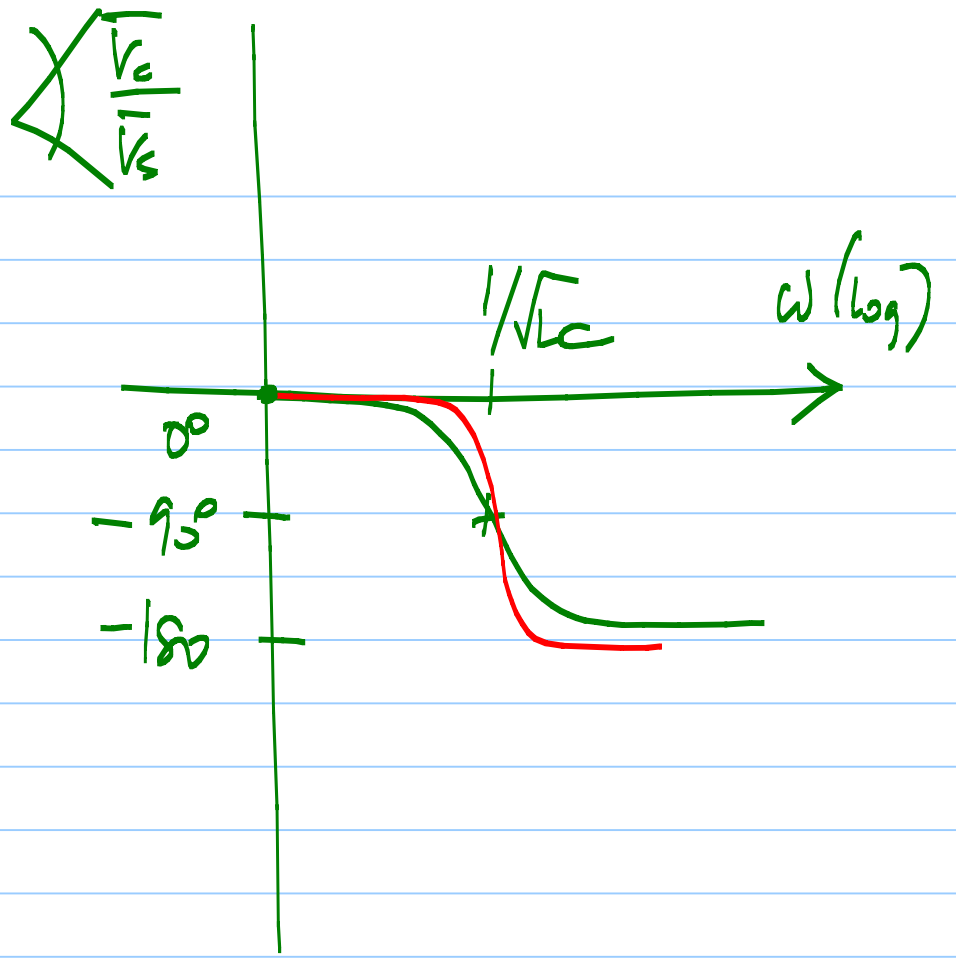
$$\frac{\bar{V}_c}{\bar{V}_s} = \frac{}{(1-\omega^2 LC) + j\omega CR}$$

$$\frac{\bar{I}}{\bar{V}_s} = \frac{1}{R} \cdot \frac{j\omega CR}{(1-\omega^2 LC) + j\omega CR}$$

@ $\omega = 1/\sqrt{LC}$

$$\frac{1}{CR \cdot \frac{1}{\sqrt{LC}}} = \frac{1}{R}\sqrt{\frac{L}{C}}$$

$$\frac{\bar{V}_c}{\bar{V}_s} = \frac{1}{(1-\omega^2 LC) + j\omega CR}$$



$$\frac{\bar{I}}{\bar{V}_s} = \frac{j\omega C}{(1-\omega^2 LC) + j\omega CR}$$

$$= \frac{\frac{1}{R}\, j\omega CR}{R(1-\omega^2 LC) + j\omega CR}$$